CALIFORNIA ENERGY RESOURCES CONSERVATION

AND DEVELOPMENT COMMISSION

WORKING GROUP

WATER ENERGY RELATIONSHIP

CALIFORNIA ENERGY COMMISSION

HEARING ROOM A

1516 NINTH STREET

SACRAMENTO, CALIFORNIA

TUESDAY, MAY 24, 2005

10:13 A.M.

Reported by:
Christopher Loverro
Contract No. 150-04-002

STAFF PRESENT

Gary Klein

Jim Woodward

ALSO PRESENT

Tuan Bui
Department of Water Resources

Attilio Zasso
Department of Water Resources

George Qualley
DWR: State Water Project

Robin Newmark
Lawrence Livermore National Lab

Elizabeth Burton
Lawrence Livermore National Lab

Laurie Park
Navigant Consulting, Inc.

Ken Broome
K.R. Broome and Associates

Matt Trask
Aspen Environmental Group

Craig Johnson
DWR: State Water Project

Tom Crooks
Navigant Consulting, Inc.

James Parker
L.A. Department of Water

I N D E X

	Page
Proceedings	1
Opening Remarks	1
Matt Trask	1
Presentation and Discussion	8
State Water Project	8
Afternoon Session	122
Closing Remarks	166
Adjournment	166
Certificate of Reporter	167

P R O C E E D I N G S

MR. TRASK: I apologize for our technical difficulties. Our projector up here decided not to work today, so we had to scramble and put in a back up system.

We are now being broadcast over the internet. I need to get the tele-conference going.

In the 2004 update to the Integrated Energy Policy Report, the Energy Commission adopted an official policy such that the Energy Commission should work with the PUC, utilities, DWR, and other agencies to explore the potential to I guess optimize and/or increase pumped storage capacity, generating capacity in the state.

Part of our working group and part of the water energy relationship has been to look at generation in water system in general, not main hydro-electric projects, but rather things like conduit hydro-electric, digester gas generation from waste water, things like that.

Pumped storage is something that definitely the Commission is highly interested in. I think there is probably more interest now that people are looking towards this 30 percent goal

for renewable energy in the state and being essentially no other way to store electricity with any sort of efficiency other than pumped storage.

I guess what we have here is an opportunity to get in on the ground floor here on a planning effort. I guess you would say just a coordinated effort to explore the potential for using pumped storage more efficiently for the existing facilities and to develop new facilities, especially related to the development of renewable energy I think is probably the main focus.

Today we are going to have a presentation from the State Water Project folks and from DWR across the street, and they are going to talk about pumped storage limitations in their systems, and then I think we will open it up to a discussion of where we want to go from here.

I should let you know the study which we will talk about a little bit later will be coming out here in a week to two weeks. After which, we will have another two weeks for people to review it publicly, and then we will have our IEPR workshop, the committee workshop on June 21. That is a Tuesday. Then we will turn to doing

recommendations to the committee and to the Commission for policy. That could Energy Commission policy, other state agency policy, it could be legislation recommendations. It is virtually wide open.

The study has some of the staff recommendations in it, but they are more sort of on the staff level, the kind of things we are recommending to our executive director.

Coming out of this -- following this will be another effort to do policy recommendations and that will go to the committee, and that will be part of the IEPR, it won't be part of our study. It could be things like well, for instance in the treatment world, we know we have a lot of new water treatment rules coming out, and not too much information about what they could mean energy wise.

We are thinking that about a rough doubling of electric demand due to these new water quality regulations, so there may be a recommendation coming out of it such as the Department of Health Services, anybody involved in water quality regulation.

We consider energy use in their

regulations, at least try to give some level of quantification as to the impact on the electric system, those kinds of things.

Possibly, water system generation. What we could do to maximize what we have, optimize what we have, what we could do to add incrementally at existing facilities, new facilities, pretty much wide open.

Personally, I'm not sure exactly what I'll be doing, but I am going to pull out of this study rotation once it gets a little crazy around here and go hopefully just to work on what we think will be the next phase of this study which will be a comprehensive program starting with a clearing house of information to assist water system professionals in managing energy in their systems.

After that, I think I will probably be leaving, so since I am a consultant, and hopefully somebody on staff will be picking up this effort and carrying it on because I do think this is a vital planning effort that really needs to be done, and personally I think that is one of the bigger problems we have is we have all these planning, but we rarely have time or resources to

carry it through to policy and real world changes. That is the opportunity here.

Any opening comments, general comments, where we are, where we are going?

MR. WOODWARD: You probably want to introduce folks that are here.

MR. TRASK: Sure. Let's just go around the room and introduce ourselves.

MR. HOUSE: I'm Lon House. I am an energy advisor to the Association of California Water Agencies.

MR. WOODWARD: Jim Woodward with the California Energy Commission in the Electricity Analysis office. Do you want to tell people what you've just handed out?

MR. HOUSE: What I've handed out is a summary of the blueprint for California water. It is not the full document, it is just an executive summary of a study and recommendations of the water agencies in this state put together. It was released at the ACWA Conference on May 6, so some of the stuff you haven't had a chance to put in to your document, and I will be filing the full document with docket, but this is just in summary, it looks at what California is facing in the future and it provides a blueprint for getting the

future with various things.

We can go through it at some point, but this is actually more for additional input to the white paper that you have done.

MR. TRASK: I can see us going over that either this afternoon or on Thursday as part of comments on this study because very definitely it is new information that we should get in there.

MR. KLEIN: Gary Klein with the California Energy Commission.

MS. PARK: Laurie Park with Navigant Consulting.

MS. BURTON: Liz Burton with Lawrence Livermore National Laboratory.

MS. NEWMARK: Robin Newmark also with Lawrence Livermore National Laboratory.

MR. ZASSO: Tio Zasso, DWR.

MR. BUI: Tuan Bui, DWR.

MR. QUALLEY: George Qualley, DWR power planning and contracts management, and we are not from DWR across the street. We are from the DWR at the General Operations Center.

UNIDENTIFIED VOICE: Apparently, that makes sense to everybody here, right?

MR. QUALLEY: We are Project Operations.

UNIDENTIFIED VOICE: Got it.

MR. TRASK: Monica.

MS. RUDMAN: Monica Rudman, California Energy Commission.

MR. BROOME: Ken Broome, KR Broome and Associates Consulting Engineers.

MR. JOHNSON: Craig Johnson, State Water Contractors.

MR. TRASK: I don't know if I introduced myself. I'm Matt Trask, the Project Manager for the Water Energy Relationship Study.

MR. CROOKS: I'm Tom Crooks with Navigant Consulting.

MR. TRASK: Tom has been putting together Appendix D, which is something we will go over later on, what I consider sort of the gist of this study which is trying to do a cost base or avoid the cost base analysis of existing water conservation efficiency programs and determine the energy cost and/or benefit from those.

That is establishing or setting the ground work for that clearing house of information that I mentioned earlier. We already have quite a bit of information out there. We do

have a web page, the Energy Commission does just for water, so we will probably be expanding that and using a lot of Tom's work as kind of the basis for that.

All right, I think we will start with the presentation from Tio and Tuan here. You guys want to do it from there, or do you want to come up and play with the machine. How do you want to --

MR. BUI: I can do it from here.

MR. ZASSO: Just as a way of introduction, back in January, Bill Forsythe from the Department gave a presentation, an overview of the State Water Project operations, and I think he might have just touched on pumped storage, but that has become a topic of discussion obviously in the white paper and of interest today. So, I thought it would be a good idea to hear it directly from the folks over the operation center that are involved in trying to make pumped storage work whenever the opportunity arise.

MR. WOODWARD: This will be in the State Water Project facilities?

MR. ZASSO: Yes, that's correct.

MR. WOODWARD: Okay, good.

MR. BUI: That's correct. I was volunteered to make this short presentation here. My co-worker of mine got jury duty, so I am ending up with the pleasure of giving this presentation?

MR. TRASK: Could you move that mike over in case there is anyone listening on the broadcast? That is the only one that goes out. That is for the court reporter there, the little one.

MR. BUI: Basically, I have with me Tio Zasso, what I call him is a walking encyclopedia of the State Water Project, just to help me out. This is a short presentation of the State Water Project overview, and then we will go into the pump back facilities.

I will be covering the Oroville Complex. I will be covering the San Luis Joint Use Complex, and then we can stick around for a few minutes for as long as necessary like George said for questions and answers.

Let's start with the presentation slide No. 1. Basically I thought I would show the department's mission, the mission is up there for you to go over. It basically revolves around managing the water resources. The State of

California and conserve and deliver the water to California while meeting all the recreation, flood control, environmental enhancements, and so on to provide benefits to Californians. Pretty much the missions for both DWR and O & M revolve around water.

The next slide will show the State Water Project map. The State Water Project started with Oroville in the north, the largest reservoir of the State Water Project with about 3.5 million acre feet of storage and then on down to North Bay Aqueduct, which takes water out of the Delta and provides water to Napa, Solano County, and then on down to South Bay providing water to Santa Clara.

Then you are entering into two divisions with the San Luis Reservoir, which is one of the largest off-stream storage in the State Water Project south of Banks Pumping plants.

Basically, it is a Joint-Use facility between the Department of Water Resources, the State Water Project, and the Central Valley Project.

Then move on down to the Coastal Branch which serves the water user from -- the Coastal Branch serves water user in the Santa Barbara and

San Luis Obispo area.

Moving on down to the Aqueduct in Southern California, we have the west branch and east branch serving Southern California.

The next slide shows the profile of the statewide project starting with Oroville around 900 feet elevation. We have a pump gen power plant there, so we are going to go into detail in a little bit in the presentation.

We move on down to Banks Pumping Plant which captures the water entering the -- that is the start of the California Aqueduct.

The Dos Amigos Pumping Plant is the largest pumping plant in the State Water Project which is joint-use between the state and the bureau with a capacity of about 15,000 CFS or so.

Water continues to travel on down to here you see the Coastal Branch basically with the highest elevation of around 2,000 feet. Go over the field and entering Santa Barbara and San Luis Obispo Counties.

Water continues to convey through what we call the Valley Stream starting with Buena Vista Pumping Plant on down to Edmunston, which is one of the highest single lift pump in the world,

lifting water from approximately about 2,000 feet to an elevation of a little over 3,000 feet elevation entering Southern California, split from the West Branch and East Branch, west, east, ending to determined reservoirs, one is Castaic with the East Branch and Lake Perris West Branch.

Along the way, basically, we have a lot of recovery generation plants, Warren, Alamo, Mojave Siphon and on down to Devil Canyon.

MR. WOODWARD: What about on the Coastal Branch?

MR. BUI: The Coastal Branch basically pretty much lift there, there is no generation there at all.

MR. WOODWARD: There is none on that side?

MR. BUI: No, not on that side.

MR. WOODWARD: Is there potential or is it just was never planned into the system?

MR. BUI: It is not planned in the system, I don't know if the economic justification is there to build a pumping plant there.

MR. ZASSO: It is typically very low glow, roughly around 100 CFS, 110 CFS, it is a small pipeline.

MR. WOODWARD: Thank you.

MR. TRASK: Are there any pressure relief facilities on it or anything like that?

MR. ZASSO: There are some, yes. Some of it is pipeline, so there are some air release systems on that, but typically, it is mostly pipeline.

MR. TRASK: If you don't mind us interrupting your presentation here, what kind of planning do you do? Is there on-going planning to look at getting increased generation out like perhaps here.

MR. ZASSO: On the Coastal pipeline?

MR. TRASK: Or anywhere, the whole system.

MR. QUALLEY: Periodically, we are kind of an on-going process to look for opportunities, I couldn't give any specifics on what the analytical thinking was on the Coastal, but obviously it is advantageous to the State Water Project and to benefit the contractors to put in recovery generation wherever we could put it.

We have like a small three MW unit up at the Thermalito Diversion Dam, and we have some other small facilities, so we are on the lookout

for it, but it has to pass the test of economics. Once again, it is an on-going process. Sometimes it might not pass the test or whatever the conditions are at the time. A few years down the road maybe it does, so we need to keep revisiting these things.

MR. BUI: Recently there is an investigation regarding putting a hydro unit at the Thermalito at the river outlet, but I don't know what came about from it.

MR. ZASSO: Actually, I've been in operations since '94, we have actually had two inquiries about putting in a recovery unit at the river outlet, and in neither case the economics of the cost of implementing the facility is enough to justify actually installing it. It is typically very low head, a lot of flow, but typically no head there, it is very small drop going into the low flow section of the Feather River.

One example of our on-going review for energy facilities, back in the 90's we built and made commercial at the Mojave Siphon Powerplant, on this slide right up there in Southern California in between our Pearblossom Pumping Plant and going into Lake Silverwood. We have

three units there and saw that as an opportunity to our energy portfolio that way.

MR. BUI: Continue maintenance and practices. We just want to make sure that we have units running. It would be advantageous to keep the units running generally and supplement our energy requirement.

MR. QUALLEY: There were some facilities that came along in the development of the State Water Project when the project was first built the Alamo Power Plant there, it was known as the Cottonwood Shoots where the water was flowing through a drop there, and they were trying to get the project built within the money that was available in the bonds. They weren't building any extra things at that time, then later on in the 80's when it made sense to do that, then the Alamo Power was (inaudible).

MR. TRASK: It was developed later?

MR. QUALLEY: Where it was just dropping the water into pyramid and then built the power plant when it made sense.

MR. ZASSO: One thing to remember is that any facility augmentation that we have has to be done at the same time as we are making

deliveries. We provide water to the State of California year round, 24 hours a day, seven days a week. Any augmentation, addition, even maintenance has to be phased in and scheduled to lessen the impact to our deliveries.

MR. TRASK: Going back to the Coastal Branch, you said it is very low flow, 100 CFS. I would assume it is also pretty variable through the year?

MR. ZASSO: It would be very low in the winter time, and then it picks up again, peaks in the summertime, but again, it is very low flow.

MR. WOODWARD: Fair amount of head, but flow, the opposite of the Thermalito one.

MR. BUI: Yes.

MR. TRASK: Right.

MR. WOODWARD: You've got a couple of thousand feet to come back down if I am not mistaken, but not much water moving?

MR. TRASK: 100 CFS, is that the maximum flow?

MR. ZASSO: Correct. That is what the power plant is designed for. There is at the Polonio Pass, Bluestone, and Devils Den Pumping Plants, there are six units available there. One

is one unit, one pump unit at each of those facilities is a spare, so we will technically run with five at a maximum. Again, we are only looking at maximum flows pretty much in the late spring through the summer time, and then it drops off in the fall time.

MR. BUI: Continue on to the next slide please. Basically, I am putting some of the bullets up there just to demonstrate the fact that we are moving water from where it is to where it is not.

As you know, we have one of the wettest Mays on record this year, and the year type this year is below normal (indiscernible).

MR. WOODWARD: What is below normal?

MR. BUI: Below normal, the year type.

MR. WOODWARD: I don't understand, the --

MR. BUI: Hydrological year type.

MR. WOODWARD: Okay.

MR. BUI: They classify a certain flow on the (indiscernible) for the Sierras and it depends on the index, it can be either wet, dry, and so on.

MR. WOODWARD: For the Sacramento Valley

water type. We are having a low hydrological year, but the wettest May on record?

MR. BUI: Yes.

MR. WOODWARD: Sort of the opposite last year, right, the driest May on record?

MR. BUI: Last year I believe it is an above normal year. Chris, do you remember? No? Yeah, I just don't remember.

MR. WOODWARD: We had a really bad month or two last year, we had some really dry weather last year if I am remembering right.

MR. BUI: Yeah, up to the third week of March of this year, we thought we were going to have a dry year, and then the last week of March, you know, the weather developed.

MR. QUALLEY: May typically, as you can expect, doesn't represent a very high percentage of hydrologic year on the average, so you get a double or triple May, and it doesn't even compare to like a normal January or February.

MR. BUI: Many job water sources are in Northern California while the demand are in the Bay Area, Central Valley, and Southern California. That is why there is a need to transport water from north to south.

I thought the next statistic kind of interesting, 70 percent of the total stream run off is north of Sacramento if you use Sacramento as a mark. 80 percent of the water demands basically (indiscernible) in Sacramento, that is why the State Water Project is there.

Some of the facts of the State Water Project. State Water Project is the largest state built multiple water project in the United States. Designed, built, and now operated and maintained by the Department of Water Resources.

We are the largest power consumer in California. We have pump lows capacity of 2600 MW. To date, I think the pump lows are about 2200 MW to date the highest. We are also the --

MR. WOODWARD: I'm sorry, you have capacity at 2600, but you don't usually hit it --

MR. ZASSO: Correct.

MR. BUI: Right.

MR. WOODWARD: -- you are a few hundred below.

MR. ZASSO: Yes. Tuan allows me to take units in and out of service to maintain them.

MR. BUI: Basically I am on the power planning and Tio is running the outage managing,

we are -- it is an aeriative process. He would like to take units off for maintenance, and I whether or not tell him that, you know, maybe it is wise to move it on a certain month because it interferes with water deliveries.

We are the fourth largest power generator in California. We have an instore capacity of just over 1,500 MWs in our system.

Almost all of our generations are renewable, generations hydro power.

MR. WOODWARD: Most of it is water running back downhill somewhere?

MR. BUI: Yes. I would say 99. something percent except for (indiscernible) which is the unit, the coal unit that we own in Nevada. That is the only unit (indiscernible) coal power plant, the rest of them are hydro power.

MR. WOODWARD: No natural gas state in-state or anything else?

MR. BUI: No natural gas, not that I am aware of.

Continuing with the overview, basically, the state water contractors, there are over 29 public water agencies that sign long-term contracts with the Department of Water Resources.

They serve over 20 million Californians with the latest census. I read somewhere that we are about 34 million in California, so they are serving about almost two-thirds of California.

Irrigates about 900,000 acres of crops, most of them are in the Central Valley. The financing of the State Water Project in the 1960 voters passed the $1.7 billion bond and started the initial construction of the State Water Project. Since then, the cost has been -- the water contractors are pre-paying those bonds with interest. They are also paying all the design, maintenance and constructions, any costs associated with the State Water Project are paid by the water contractor.

Going on to the State Water Project facilities, we have 21 major storage facilities starting with as I mentioned earlier Oroville in the north with 3.5 million acre feet for storage.

With Castaic Lake on the West Branch, and Perris on the East Branch in Southern California. We have 29 pumping plants and generating in the State Water Project. Again, the largest generation plant is Hyatt in Oroville. The largest pumping plants once again

(indiscernible). We have over 670 miles of canals and pipeline to transport water from the north to the south.

Our water delivery of the State Water Project, maximum entitlement is 4.1 million acre feet contractual between the Department of Water Resources and the state water contractor.

The average annual delivery to date is about 3 million acre feet, and the split between the end user MNI about 50/50.

MR. WOODWARD: MNI is --

MR. QUALLEY: Just a comment on that first item, we are probably not supposed to use the word "entitlement" anymore. It should probably say Table A, that's the maximum that was originally contracted for, and that is the basis for establishing the cost that are charged to the contract, but the project as it currently sits can't deliver 4.13, but that is what the original design in the original contracts were signed for.

MR. TRASK: What is the maximum you could deliver?

MR. QUALLEY: We are probably looking at it this year --

MR. BUI: Systems peak --

MR. QUALLEY: So far in history, it has been 3.6 million acre feet.

MR. WOODWARD: Is that what the system is capable of delivering? I'm sorry, I am ignorant here. I am relatively new to California, and some of this stuff is like Greek. A little bit of history would be helpful. The intent was to figure out to deliver just over 4 million acre feet a year or something like that. That was the original intent when back in the 60's when the project was started, right?

MR. BUI: Yes.

MR. QUALLEY: To deliver that amount, you would have to have a delta transfer facility which some people would refer to it peripheral canal, and that was part of the original design of the project. (Indiscernible) to more efficiently get the water through the delta would be required to get the 4.13. Obviously that is not in place. So, with the facility as currently configured, our experience to date has been about 3.6 million. It depends on a lot of different factors. I mean, you have to have a lot of combination of things coming together. It is not just a total amount of rainfall you get in a year. It depends on when

you get it, if (indiscernible) is healthy, you can get a lot of precip and have it raw off early in the year and wind up not filling your reservoirs.

Or you can get really cold storms in a below normal year like this year, and you are in great shape because of it. The snow pack is up (indiscernible). So, a lot of things play into, you know, the total amount you can wind up delivering in the system.

MR. BUI: Earlier, I mentioned MNI. MNI is Municipal Industrial.

MR. ZASSO: Going back to the demand pattern. Looking at the split of about 50/50 for agriculture and urban, your agriculture demand will start picking up in the later winter/early spring, peak in the summer time, and then start dropping off in the fall, and I have I call it a maintenance level through the winter time. Your urban, your MNI, that is a little more flat type of demand pattern. It will typically drop some in the winter time, again, peak in the summer. It is typically a flatter pattern throughout the year.

MR. WOODWARD: Certainly compared to the ag.

MR. BUI: Yes.

MR. ZASSO: Compared to the ag, yes. Will we ever get over 3.6 million acre feet delivered? Potentially.

MR. WOODWARD: You need some additional infrastructure in order to move, to have the capability of moving the water out of the Delta into the canals if I am hearing correctly.

MR. ZASSO: The year we moved 33.6 million acre feet, we are doing that with our current facilities that we have. Basically we have to have the demand in order to move the water supply, either ag or urban. We've got to have a place to put it.

MR. TRASK: Tio, I assume right now that you have already filled or are filling San Luis as much as you can?

MR. ZASSO: Actually, we filled it.

MR. TRASK: It is full, okay.

MR. ZASSO: As I'll get into later, we are actually starting on our yearly cycle downward for delivery.

MR. TRASK: So, if you are going to get that, I'll hold off.

MR. ZASSO: Yeah, I'll cover that.

MR. BUI: It will be in Tio's

presentation. State Water Projects operation basically in Sacramento we have an operation control office. We direct planning, the overall water and power operation of the State Water Project.

The fuel divisions are basically located throughout the state. In the north we have Oroville, in the south we have few divisions. Basically, they carry out directives of those OCO, Operation Control Office. We tried to preserve waters, provide water supply within the constraints of flood control and environmental requirements and others which I will get into a little bit.

With the water constraints we have maximize our off-peak pumping when it is cheapest, and we optimize our on-peak generations when it is the most value.

I would like to emphasize basically the power production of the State Water Project is basically the by-product of the water operations. The goal is to deliver the water first and power generation came with it, not the other way around.

MR. QUALLEY: That's not to say that we are not making upwards to be as efficient as we

can in our power operations. Obviously we want to do that. We have to minimize the net cost of the contractors, but we have to deliver the water.

MR. BUI: Exactly.

MR. WOODWARD: How are you doing on net? I mean, if I understand what you just described about pumping as much off-peak and producing as much as you can on-peak, what is your annual net look like?

MR. BUI: We are over all the net consumer. What we are trying to do is we tried to play as much on peak generation as possible to offset some of the -- did I say off-peak -- on-peak generation as much as possible. Offset for some of the costs that we have to purchase power during the off-peak hours.

MR. WOODWARD: I assume someone actually pays you more during on-peak for electricity than you pay off-peak to buy it, at least I am hoping that's true.

MR. BUI: We also entering long term agreement with the utilities to doing exchange type. Basically, we provide on-peak generations for them to supply for their urban lows and then in the off-peak, they provide us with power so we

can pump the water from north to south.

MR. TRASK: Since the utilities don't really own much in the way of generation, how is that working, or is it just coming from the nuclear plant?

MR. QUALLEY: We are probably never going to have a situation like we have with Edison where we had one huge contract that basically dealt with about two-thirds of the power needs. That was a 20 year contract that expired at the end of December.

What we are looking at now is there will be a cost of evolution of a power portfolio where we want to maintain a good mix from all standpoints really, from fuel source, from the counter parties to mitigate the credit risk, you know, the sources, the locations, just --

MR. TRASK: You are just out there every day in the markets seeing what you can find --

MR. QUALLEY: It is a mix of short term transactions, mid term, and long term transactions. We are in the process of building the portfolio. We will always be in the process of actively managing it and turning it over, and we want to have a variety of terms. We've got contracts beginning and ending at different times,

so that we don't get stuck to any one fundamental assumption of how the market is going to go. We want to be in a position where we can change as the market changes and take advantage of other opportunities and new technologies.

MR. TRASK: Is it the same people that handle both your purchasing and selling?

MR. QUALLEY: The staffs work closely together, Operations and Control Office, they are dealing with the shorter term transactions.

MR. TRASK: I'm just curious because it is part of the reorganization that was announced is that the purchasing people would be coming to the new Department of Energy with the generating --

MR. QUALLEY: (Indiscernible).

MR. ZASSO: (Indiscernible).

MR. QUALLEY: We are all just project --

MR. ZASSO: State Water Projects.

MR. BUI: This is strictly State Water Project that we are talking about.

MS. NEWMARK: I was at a water conference last week at which where someone from I think Southern California Edison pointed out that during the brown-out period last year, the State

Water Project actually shut in some of your pumping during peak times and just slowed down the water. I would like to know if this is true, and the extent to which it is true that your actual pumping facilities, your working against the power crisis in the state. Is that a true fact? To the extent to which it is true would be helpful to know.

MR. QUALLEY: There were times during the crisis that State Water Project did respond to help out the situation. One thing we've got to keep in mind is that as Tuan said, most of the State Water Project pumping is in the off-peak period, so we are typically not out there adding to the problem in the on-peak period. We do some on-peak pumping in the shorter hours, but we very rarely do any pumping in the --

MR. BUI: (Indiscernible).

MR. QUALLEY: -- (indiscernible) peak period. So, just with our normal operations, we are usually helping the situation rather than hurting the situation. There were some times even during those shorter periods where we were in the position of where upon the request of the independent system operator during a Stage 3

emergency, we are going to (indiscernible) some load and help out with the overall situation.

MR. ZASSO: One thing you have to remember, every time we are asked to shed load for an event like that or an event where we program, it is within the confines and the operational parameters of our system. If we shut off pumps pumping over the hill to help out the grid, we are still going to make deliveries. We have scheduled deliveries independent store contractors down stream. They are not going to shut off their demand mode if you shut off pump pumping. Basically it comes out of storage. We have got to replace that storage some where along the line.

Because one, that is water supply, that is critical, that is critical as the grid. We have on our East Branch if you noticed on the slide earlier, we have not as much installed storage capacity on the East Branch as we do on the West Branch. We have about a 70,000 acre foot reservoir in between the Edmunston and the terminus reservoir at Lake Perris.

If we have a problem or curtailment for energy reasons, that's where I get water to deliver. You can only go to that place so many

times. Again, it is a constant balance. We can help the grid out at certain times, but we are going to make that water up. We are going to have refill those reservoirs up at other times as we need to.

MR. WOODWARD: Basically that means you have to run more hours off peak, put another pump on for awhile to do your makeup or something, right?

MR. ZASSO: What it would typically mean is that we are going to fill up our light load pumping hours, our off-peak pump period. We are going to have to actually probably add more pumping during the shoulders and potentially into the on-peak in order to make that water up downstream.

MR. WOODWARD: You are already running maximum flow during off-peak hours?

MR. ZASSO: That's what our target is.

MR. WOODWARD: That is what your target is.

MR. ZASSO: That is what our target is, yes.

MR. WOODWARD: You described earlier, you got a few hundred MW's of pumping in reservoir

mostly for maintenance purposes. So, to the extent you can fill up a bit more in off-peak, you do, but you have to maintain the stuff, otherwise, you are in trouble.

MR. ZASSO: We are pretty much running off-peak at capacity. Any other opportunity to make up any water that we've taken out of storage is going to come in either the shoulders or the heavy load period. A good example at Edmunston, we have 14 units installed there. They are 16 MWs a piece, they are roughly 325 CFS a piece.

We can only run 13 at a time. We are hydrologically limited due to the configuration. That allows me to have one unit out of service throughout the year and still not have any impact on our capacity to deliver water. So, I am going to fill up in the light load, I'm going to run 13 units at night.

MR. WOODWARD: All the time?

MR. ZASSO: Most of the time.

MR. WOODWARD: Just move water up and get it into storage.

MR. BUI: When the demands are there.

MR. ZASSO: Right, when the demand is there. If I curtail for any reason, and I take

storage downstream, if we are filling up the shoulders hours are filled up, I've got to add some extra pumping in heavy load to get there.

MR. BUI: Basically, there is another aqueduct. In our reservoirs, there is a draw down limitation. So, you can't just drop the elevation in the canal and in the reservoir too fast, otherwise you are going to pop all the panels off the aqueduct. That is one of the operation constraints as well.

MR. WOODWARD: Pop the panels meaning the side walls come off?

MR. BUI: Yes, they come off.

MR. TRASK: Right, the soil on the outside is saturated and if you remove the pressure from the outside, that soil just pushes right in.

MR. WOODWARD: Clearly as you said earlier, your mission is delivering water, and energy is a nice feature and an expense, but your mission is to deliver water and that is primary, by at least an order of magnitude or two?

MR. ZASSO: Correct.

MR. BUI: Yeah, we --

MR. WOODWARD: We are not putting

(indiscernible), we are going to make sure it is clear?

MR. BUI: Right, yes.

MR. ZASSO: Again, on the question that was brought up, we are in regular communication interaction with the independent system operator, with our scheduling coordinator, and schedule our lows through the ISO, but we are in regular communication on that very subject.

What the State Water Project's operating constraints are, what we have to offer as far as things that we can bid into enough to help in the overall grid operations. I was just at a meeting a couple of weeks ago where managers from the ISO and the department got together just to talk about the subject, so we have a clear understanding of what each other's needs are and what the constraints are, so god forbid, get it from other states for your emergency where things will be smoother than during a crisis. Hopefully, we don't have another crisis like that.

MR. TRASK: That's why we are here.

MR. BUI: That was the end of my State Water Project overview. If you have any questions, we are happy to answer it.

The next part would be the pumped storage facilities. I will start with the Oroville Complex. Tim will finish the presentation with the San Luis Joint (indiscernible) Complex, and then we will be around for question and answer.

Basically, the principle feature of the State Water Project is the Oroville Complex, and the principle feature of the Oroville Complex is, of course, Lake Oroville, and then you have Oroville Dam and Lake Oroville, and we have the Hyatt Power Plant which is about 800 plus MW of capacity, and then we have the Thermalito Diversion Dam.

From there the water diverts. There is two ways the water can travel. One is through the power canal on down to the Thermalito Forebay. The other is as the water continues on to the natural channel of the Feather River on down to the meeting the (indiscernible) of the Sacramento River.

At the Diversion Dam, we have the Fish Hatchery there. We also have the Thermalito Diversion Dam Power Plant, which George mentioned earlier. We have about 3 MW power plant there, which is primarily used for station service for

Oroville.

At the end of the Thermalito Forebay, we have the Thermalito Pumping and Generating Plant which discharges the water into the after bay. The after bay is basically primarily used to maintain uniform flow discharge back into the Feather River. It is also used as a power regulation, regulate reservoirs both forebay and the afterbay, as well as using as a warming basin for some of the diverters. They would like to have warmer water than cold water.

MR. ZASSO: The primary water uses out of thermal (indiscernible) off of rice production?

MR. BUI: Rice production and the water rights diverts about in the neighborhood of a million acre feet a year.

MR. TRASK: That is the first I've heard of that.

MR. BUI: The Feather River service area.

MR. TRASK: How much warmer do they like that rather than --

MR. BUI: The next few slides I will show you how much. Sometimes it is in conflict with the fish interests.

MS. NEWMARK: Where does that water --

MR. TRASK: That is what I was going to get to, yeah.

MS. NEWMARK: You actually use the afterbay as a water source. Where does it come off the afterbay? You discharge to the Feather River for water supply and maintenance of the river itself, is that also the location where the water goes for water supply, or do you have another --

MR. BUI: There is about four major --

MR. ZASSO: (Indiscernible).

MR. BUI: Outlets along the --

MS. NEWMARK: I don't see it.

MR. BUI: It is not on here.

MR. ZASSO: There is one here, I think a couple along here, and some up here.

MR. BUI: Two in the north and basically two in the south of the four basically, these are the people taking water --

MR. ZASSO: Ridgevale.

MR. BUI: Ridgevale, Sutter Buttes, Joint District up there.

MR. TRASK: I assume it is a relatively shallow --

MR. BUI: It is a shallow -- it is basically the afterbay around 136 elevations with 55,000 acre feet of storage.

MR. QUALLEY: Just for reference, this is the river outlet where Tio had mentioned earlier there had been various efforts to figure out if there is a power recovery facility that would be feasible there.

MR. BUI: We will go on to the next slide. Basically, Oroville Dam is the highest, 770 feet highest in the United States along with two other saddle dams, it empowers Lake Oroville. Lake Oroville is at the maximum operating storage of 900 feet. We have about 3.5 million acre feet.

MR. QUALLEY: We've got a picture in our conference room. On June 10 of 2003, it was 899.48. That is hard to do.

MR. BUI: You have to just write it just right without spilling or anything.

MR. WOODWARD: You got right up there, that (indiscernible) was good, huh?

MR. QUALLEY: Where the winds were favorable that day.

MR. WOODWARD: Pushing back up the dam, right, right. Okay.

MR. TRASK: I've never seen it in action, but the spill facility there, what level does that go. I mean I've seen pictures of it, and it looks unbelievable.

MR. BUI: 901 is the emergency spillway, and the gated spillway is about 830, 830 feet elevation, 830 at the bottom of the gated structure.

MR. TRASK: We didn't spill this year I assume?

MR. QUALLEY: Not yet.

MR. WOODWARD: What is the lower one called, I didn't.

MR. BUI: The gated structure and the other one is basically is over the top emergency spill.

MR. WOODWARD: Just over the top, right.

MR. QUALLEY: I powered over that in a helicopter, and it was just towards 150,000. It was pretty impressive.

MR. TRASK: If anybody hasn't seen it here, it is really impressive. It is just this big runway of water and then it hits a diversion and just goes straight up a couple of hundred feet anyway.

MR. BUI: At the end we have an energy dissipators to prevent a lot of scouring of the Feather River there.

Next slide please. The pumped storage facilities. Basically locating in the bedrock underneath Oroville Dam is the Hyatt Power Plant. The largest of the three plants in the Oroville Complex.

It has six units, three conventional generations and three pump gen units. The capacity is about 820 MW with flow capacity of about 17,000 CFS there.

Generator capacity basically varies with reservoir level, the highest during I think around June, late May, June, that is when the fill the reservoir and we drink the reservoir and we go to September, October, November, and so on.

Pumping capacity. We have three units that have capability of pump gen, about 5,600 CFS of flow going backward.

MR. WOODWARD: The system is pretty much designed to carry the loads of the way we get water in California. When water supplies vary rather dramatically, like lots of precip but no snow, what happens?

MR. BUI: Basically, Oroville is a multi-purpose dam, we have flood control on there. The maximum flood control reservation is about 750,000 acre feet. It starts September/October time there, and it is measured by the wetness index.

We have eight stations that in the Feather River Basin. It depends on the wetness index. It dictates how much space we have to vacate to meet reservoir requirement. So, during late fall/winter time, we in flood control operations, the reservoir is (indiscernible) to its allowable, and that would provide us room to capture the water, store water, and release as necessary.

MR. TRASK: Does that change through the season?

MR. BUI: It does change through the season. Starting in September and then ending around like this time May/June, it depends on how wet it is. Typical year, we don't have any reservation flood requirement about this time of the year.

MR. TRASK: One of the things we are exploring is well, obviously drought is the worse

situation, but we are also seeing that if we shifted to a lot more rain and less snow, that would have a huge impact on water supplies.

For instance, if we started getting to a situation where we are getting almost all of our run off say in March, you know, earlier in the year, would that be even worse for Oroville, would you always have to keep a little bit of flood control even into May?

MR. BUI: We try to capture as much water as we can, that is basically, to secure our winter supply. In March, if I'm not mistaken that is basically when you have a lot of rain, that would be the maximum flood control requirement, so you have to have $750,000 acre feet empty in the reservoir to make sure that you would be able to capture that water if the water showed up.

MR. ZASSO: As Tuan mentioned, one of the parameters that we calculate on a daily basis is this wetness index. It was established and developed in accordance with the Corps of Engineering criteria for the reservoir.

It looks at the previous days' wetness index, today's precip, and takes a percentage of yesterday's wetness, and calculates a new number

for today. That tells us where we are on the flood control curve.

If we are dry and we are down a low wetness index coming into March, we are allowed a little bit more. April 1, the curve starts going up and allows us to start utilizing a little more space each day as we get out of the rainy season.

Typically in March, we are running pretty much close to that bottom of the flood control curve that we are allowed to have.

MR. TRASK: The curves, are they constant every year, do they never change?

MR. ZASSO: They are the same. Actually those curves were developed back in 1970 with the US Army Corp of Engineers.

MR. QUALLEY: On your point on the global warming with the flood reservation that Tuan talked about that said around 50,000, that capacity was actually purchased by the Corps of Engineers when the project was built. So, it is operated to their criteria for the flood reservations. Now, if through global warming or some other reason the hydrologic picture changes to where you have these warmer storms that it would change the run off characteristics and so

on, right now -- well, initially and I think they recapped it again a few years ago, they calculate a level of protection that is provided by that flood reservation.

They would probably go through another calculation and determine, hey, that is $750,000 doesn't provide as high as level of protection as it did years earlier.

MR. TRASK: How often do you do that, is it constant that you reevaluate that?

MR. QUALLEY: If the Corps call and want to do that, basically, they will do it when there has been enough additional data. They recap it again after the '97 flood. Either a number of years have gone by or more importantly some significant flood events, that tends to change the statistics over the number of years they look at.

MR. WOODWARD: That 750 you pretty much have to let the level go down that much for flood control and effectively that has to go down pretty early, you have to let that drop somewhere in January you have to start dropping it down or something like that.

MR. BUI: Actually, the flood controls enter in the curve actually start in September 15,

that is the official date that you actually have to drop. If there is no rain there, basically, there is no flood control. The index will be zero, so you can maintain your reservoir as the level that is desired. As soon as it rains, the wetness index start to dictate how you operate during the rainy season.

MR. WOODWARD: If your reservoirs are fuller than the 750,000 on September 15, but there is no rain, you can keep them there. As soon as it starts to rain, you have to start going down that curve to hit the minimum at some point in order to allow the rains to come later on.

MR. QUALLEY: Typically, by the time you get into November, you are going to have that full $750,000.

MR. TRASK: You can always drain faster than it fills?

MR. ZASSO: Yeah, at that time of year in the late fall, there's typically little in-flow. We are still making deliveries out of Oroville for our environmental and regulatory compliance requirements. There is still some water running for our (indiscernible). The bottom line, there is not usually a problem with us

entering into that season by having it too hot.

MR. QUALLEY: Typically our target is what, around a million and a half in the fall?

MR. ZASSO: Right.

MR. QUALLEY: We have 2 million acre feet there is when you start filling. You typically wouldn't start getting the flood control criteria until late December, more likely in January.

MR. ZASSO: If we do encroach into that 750,000 acre feet of space, we have to coordinate operations with the Corps of Engineers and our flood center in DWR flood center to plan out and show them this is how we are going to get out of that encroachment.

MR. WOODWARD: Have you either separately or together with the Corps of Engineers thought through some of the scenarios that Matt was describing that if you get rain patterns and precipitation patterns radically different from what was originally intended, have you thought through that at all?

MR. QUALLEY: I'm out of that loop right now. I used to be in flood management, but that is the type of discussions that would be on going. The Corps is thinking about those type of things

all of the time.

MR. ZASSO: As far as our office, no, we haven't entered in to any of those discussions, different group.

MS. NEWMARK: EB Mud has a similar situation. They own a water shed and have to monitor and maintain it for flood control, and they are very concerned about the timing of the run off and the impact on their flood control requirements. In fact, they've had to have negotiations with the Corps of Engineers twice in the last decade to get some relief on the timing because in California, we have this drift to earlier spring run off, but we also have a very commonly a bimodal precipitation pattern.

If you are managing for water supply and you get a bunch of rain in December and then you don't have rain in January, the question is when are you going to get hit in February/March or not. That is really the question.

The Corps of Engineers is evidently very interested in looking at this general change in seasonality for just the same reasons that you are bringing up here, but they haven't been told, they haven't gotten to the point that they are going to

do it yet. I know that the water managers are also wondering, you know, is there a point where we need to change the rules based on the seasonality. Still manage for these requirements, but maybe move the month, the bench point month from March to February or September because in recognition of the trends. I think it is discussion that should be coming up soon.

MR. WOODWARD: Make sure it is a recommendation, I think, for you all to us. We ought to get a group of people together to talk it through a little bit. We have some folks at Scrips working on sort of climate change weather issues, and they are doing some earlier forecasting than normal, and you all might want to hear about what we are looking at, and they might want to hear what your issues are. I think we can set something up to do that just to learn. I don't know what we should do about it yet, but I think we ought to take advantage of the folks that who are thinking about it to bring them all together and talk about it a little bit.

MS. PARK: I also might mention that among the water people, you -- I'm sorry. I used to manage the releases for Hetch-Hetchy. There

are groups of people that get together regularly to share forecasting methodologies. All of this discussion raises some really interesting concerns on my part that were challenges every day that I was at Hetchy.

First of all, on the forecasting side, I note that we worked with DWR as well on this closely. We worked with 76 years of historical precept. In that 76 year history, you get all kinds of patterns. So, you know, we weren't as concerned about the climate change impacts because we had situations where you had a really heavy snow pack early in the year such as November/December. Then you had a pineapple express come through the first week of December and everything went down.

You have all of those circumstances, you have circumstances where you have very very wet years, really nice snow pack, and then nothing after February. So, you would get in that 76 range of history in theory, you get a pretty good distribution of all the kinds of occurrences that you can have.

Here is one that I think is really interesting, and that is a water agency needs to

manage its operations for water supply, of course, and there are some very difficult decisions being made by people every single day about how to best protect that water supply.

It has to do with precisely that which is you know what you have as far as precip and snow up until today, you don't have any idea what is going to happen tomorrow or the day after. So, you are constantly trying to manage that both for flood control purposes and for water supply, and the power is like the least of your concerns. Realistically for Hetchy where Hetchy was a very valuable contributor to the general fund, and that contribution came from power revenue. There was more pressure on us all the time to be continually optimizing that resource.

So, here you are, you are faced in September or October. You've got high power prices in the market. I could either buy or generate, and on the water supply side, there is strong pressure to hold that water. On the power side, there is great tension to release that water. The real issue to me always came down to science, which is we have such a little grasp on our climate and on our precip, what to expect.

There are different services out there that we paid a lot of money to that told us that there was a 30 percent probability the year would look like this. Who is going to bank your whole water supply on the basis of a 30 percent forecast.

MR. WOODWARD: I like to gamble, you know.

MS. PARK: It is really a very troublesome thing. At least when I was with Hetchy, there were a number of studies going on that we participated in, and I frankly don't know what the status is of them right now, but some of them were, for example, to do satellite imaging out the snow pack to try to estimate the density, to relate it to prior years as to how dry they were, you know, and therefore how much run off would occur and how much would sink into the ground, etc. It strikes me that maybe the time is now, maybe because my understanding is the very same years that Hetchy held on to its water and then had to release it in a hurry and throw the water down the mountain without passing it through the turbines, we were certainly not alone, and pretty much every hydro generator in California

was doing the same thing.

I have often wondered how much of an impact that would have on power if we had better methods, both for being able to project water supply, but also maybe what we also need are some other mechanisms to provide the water supply hedge, you know. That is where it gets into things like how valuable is desal.

MR. KLEIN: We are making those trade offs. What would be the key month that you would like to have more data.

MS. PARK: Every single one of them, but basically, pretty much it was --

MR. ZASSO: That will vary from year to year.

MR. WOODWARD: Just to make it simple.

MR. ZASSO: Just to make it simple.

MS. PARK: Realistically, and you've been there, right, I mean we had situations where all of the sudden, we were pouring water down the mountain in haste, well January '97, but that was unusual.

As we go back in history, and it strikes me the State Water Project doesn't have as long a history as some of the operators, you know, we

have years on record where we had tremendous snow packs that came down in November and December and then very dry periods thereafter, and so what that really speaks to is the system design flexibility, the ability to manage these kinds of extreme conditions, and yet be able to protect, you know, optimize both our water and power resource capacity. It is really tricky.

MR. TRASK: You are saying the only thing that is consistent is inconsistency?

MS. PARK: There is that, but it also really speaks to, you know, given that our science isn't where we need it yet, flexibility in the system. You know, as I was listening to the discussion in the State Water Project, for example, what I heard was that you have a certain capacity you have to deliver 24/7. If you have anything that disrupts that pattern, you have to group it, and then you have to make it up.

What would alleviate that and give you more flexibility, you know, more diameter in the pipeline, more interim storage capabilities along the way, something. I mean, there are mechanisms for building more flexibility into our system such that we can better optimize the combined water and

power resource.

MR. KLEIN: Facilities, infrastructure just like, for example, without advocating through Delta conveyance or Mojave Desert storage over the hill might allow for more flexibility in the dispatch of water.

MS. PARK: You know more about your system that I do. I presume that's true.

MR. WOODWARD: Okay. I am assuming the DWR folks are actually really thinking hard about this. It is not something you ignore, right?

MR. QUALLEY: Yeah, absolutely. I mean one comment I was going to make, even though the three of us aren't directly involved in some of these studies on extreme flood events and global warming or that type changing, at the Division of Flood Management, they are tapped in with the Corps of Engineers and all the different scientific entities to continue studying that area.

One other point, too, the point was made about the difficult decisions for water management, do you keep the water, do you let it go. That's one of the primary reasons why when you have a multi-purpose reservoir with a federal

flood control reservation that the federal government has bought and paid for, that's 750,000 acre feet, so they are in charge of that part of the operation, and we have very specific operating criteria to stay within their criteria.

If there are special circumstances where it might make sense to vary from that, we would be in communication with the Corps and they would make the call, they would make the decision. It makes sense to either up the release or do something different. That is an important point to remember.

MS. NEWMARK: I have one comment. I know there is a joint working group between DWR and US Bureau of Rec to look at climate change impacts on their infrastructure and operations. So, there actually is an active group, and they are actually primarily focused on the Delta, but through the CAL Sim model, of course, they include every note, every dam in the whole system.

Not these gentlemen, but portions of the State Water Project are actively pursuing at least looking at the impacts, if not, trying to figure out the implementation of mechanisms to address to respond to that.

MR. BUI: Are you referring to the CAP studies?

MS. NEWMARK: It is a joint working team led by Francis Chung's group, the modeling group and Lloyd Peterson --

MR. BUI: Okay. Lloyd Peterson.

MS. NEWMARK: -- over in the Bureau of the Rec --

MR. BUI: (Indiscernible).

MS. NEWMARK: (Indiscernible) -- who just moved to Denver with (indiscernible).

MR. BUI: Okay, to Denver, uh-huh.

MS. NEWMARK: Jamie Anderson. Do you know her? She is in --

MR. BUI: No, I don't know who Jamie is.

MS. NEWMARK: She is a DWR person in Sacramento, and she is involved in it.

MS. ZASSO: I'd like to make one comment. If there is any facility augmentation expansion on our system as one of our previous slides indicated, don't state water contractors pay for all of the bills for the operations, for maintenance, administrative costs, regulatory costs. So, anything we do as far as an augmentation to our system is coordinated through

them. They are certainly involved in that process.

MR. TRASK: I'm glad you brought that up. I wanted to get that and maybe Greg if you want to join us. I just talked with one of your co-workers about the planning process with the State Water Project people. I know you meet at least monthly on general issues, operations issues. What about your planning process, is that a regular every year, twice a year, or is it formal at all?

MR. JOHNSON: Yes, like I said, we have oversight involvement. Well, I wouldn't call it really oversight, a coordination would be a better word, you know, to make sure that the projects make sense economically, operation wise, water delivery wise, and that coordination is again, we would have meetings that go from weekly meetings, monthly meetings on shorter term issues all the way up to the longer term issues. A presence in all of that.

MR. TRASK: Like for instance, you know, there are two things that we talked about today already, your outlet there from Thermalito, you explored putting a small generator there. The

Coastal Branch, aqueduct, is there any sort of set process where you would like regularly reassess those kinds of things, look at what new technology is available, low head high flow, high flow, low head, that kind of thing. Is there any sort of formal process to regularly look at those kinds of things?

MR. QUALLEY: As part of the planning process, yeah, we are always on the outlook for new technologies, changes in the facility configuration, anything that can provide us a better more efficient operation.

For example, we've got a project under construction right now to build we call it Tehachapi (indiscernible), we are actually at the top of a hill, (indiscernible), we are building a small peaking storage facility up there that will allow us to take better advantage of the off-peak pumping capability of the valley strain. Right now it is constrained by the capacity of the East Branch and the capacity of Pearblossom Pumping Plant to take the flow.

By having that peaking storage facility up there, that will give us just enough storage to be able to hold it long enough to take more

advantage of the off-peak pumping capabilities.

We are looking for those types of things where we can make changes to the facilities, make changes to the operations, to the extent there is new technology that can be advantageous to us. That is part of our process.

MR. WOODWARD: A similar question would then become -- I'm not clear exactly who the entity would be, but MWD is an example, they are a big buyer of water, right? They gather --

UNIDENTIFIED VOICE: The biggest.

MR. WOODWARD: Huge, right, but my point is if you are looking for opportunities, I wonder how you are coordinating with folks like them to do the same thing, to take peaking water and store it for use --

MR. QUALLEY: As Craig indicated, we are in regular communication virtually all the time with like Craig works with the Water Contractors Corporation, we also work with individual contractors. There are various committees that they have. Our operating people are in regular communication. Tuan is on the phone to the especially the larger contractors on a regular basis to make sure that we have a heads up on

changes that are going to be made, things that we can do that would be to everybody's mutual advantage. There is a regular flow of communication.

Obviously the department is making the decisions and running the project, but we certainly want the input from the contractors on a regular basis, both would have the best information that is available on what their plans are and also we want to take advantage of whatever expertise is out there.

MR. BUI: We are constantly in contact with MWD especially. We coordinate outages, make sure that water is being delivered at the time that is least cost for them, make sure they don't take water at the time that they simply require too much on-peak pumping and so on.

However, if their demands are needs to be delivered, we have to deliver the water. Basically the bottom line, we coordinate with the contractors all the time just to minimize the costs.

MR. QUALLEY: For example, they might put a schedule in, and that would be based on their calculations, that is where they need the water.

Tuan and his staff would run the studies and see what the implications are, and that is where you would get back on the phone, did you realize that, do you really want to do that, do you want to tweak it a little bit, and that interaction is going on all the time.

MS. BURTON: You noted that the state water contractors share the costs of the State Water Project. Do they also share in the revenues from power generation? What I am driving at is, is there a way to get them to think about optimizing the power and the water as opposed --

MR. QUALLEY: Trust me, they are thinking about it all the time.

MS. BURTON: -- to worrying about the water supply.

MR. BUI: They are not sharing the costs, they are paying for the cost of the State Water Project, all of it.

MS. BURTON: Right, right, and do they get the revenue back when you generate power?

MR. BUI: Yes, as a form of -- I'm not well --

MR. JOHNSON: Like you said, there is usually a net bill for power, so it is netted out

against the cost.

MR. QUALLEY: We don't look at it as revenue, it is offsetting costs.

MR. JOHNSON: It offsets the costs.

MS. BURTON: (Indiscernible).

MR. TRASK: What type of planning horizons do you look at? In other words, like this new afterbay that you are putting in, what sort of pay back period or amortization period do you guys look at in your planning?

MR. QUALLEY: Was it ten year on that particular one?

MR. ZASSO: I don't recall.

MR. BUI: It depends on the energy price at the time that you did the study, and I forgot what it was. Ten years sounds familiar.

MR. QUALLEY: It seems to me that was the pay back horizon with some fairly conservative assumptions as far as off-peak/on-peak differential.

MR. TRASK: Is that fairly consistent? In other words, whenever you look at an improvement, do you assume it is ten year payback average?

MR. QUALLEY: I wouldn't say that is

standard. We need to look at each circumstance individually.

MR. ZASSO: On the maintenance side, when we are looking at facility enhancements or component replacements, we are typically looking at the life cycle of that particular component in 20 years, 25 years, 30 years, and balancing that cost with the foreseeable use life of that component.

MR. TRASK: For instance, there is a lot really good new motors out on the market now just in the last few years. The efficiencies have really boosted up, is that the kind of thing that you look at it going that I've got this pump in place, I've paid off half of it, but there is another pump here that, you know, might even pay off quicker?

MR. ZASSO: Most of our equipment is fairly non-standard if you will. I mean, there is not a lot of other projects like ours in the world. At Edmunston Pumping Plant that we mentioned earlier, each unit is a 60 MW motor. There is not too many out there that are going to be able to come in and light for light replace that.

MR. WOODWARD: You have six of the 60 MW made anywhere in the world?

MR. ZASSO: We have 14 of them.

MR. WOODWARD: You own 90 percent of them probably.

MR. ZASSO: Probably.

MR. TRASK: A lot of our nuclear power plants have some pretty --

MR. BUI: They are so large that you cannot directly start them up on the grid. You have to use a motor generator to start them up, otherwise you will basically pretty much take out Fairfield. That was actually occurred twice in the history of the department. That they asked, we start it up one time, they say, hey, you guys can't do that. You have to coordinate with us first because you would power surge.

MR. ZASSO: On our smaller auxiliary systems, yes, that is something that is looked upon that are more standard size frame size, horse power size. When a motor burns up for whatever reason after running for 25 years, they are certainly looked upon as balance whether they repair that motor or just go buy a new one off the shelf. Most of the time, the age of some of our

equipment is getting, we are just replacing them right off the shelf.

As far as our big units. I will say our unique units, those are pretty much replaced. We may replace internal components with new and improved, but by and large, again, a lot of our equipment is fairly unique.

MR. WOODWARD: I am also assuming that you are trying to be high up on the efficiency curve in any event. I realize a percentage point or two with those numbers makes a big difference, but you are already in the 90 somethings on the full scale pumping I am assuming.

MR. ZASSO: Most of the time. In the last 10 years, 15 years, they have been going through each of the pumping plants. We are implementing a new program here for the next few years, and hopefully for the rest of the life of the project on the condition assessment program where we are going in to each particular unit and doing a wire to wire inspection of that unit, looking at ways that we can improve the life and the efficiency of those units.

Again, we've got some fairly unique pieces of equipment out there that we don't have a

lot of flexibility in changing it. Not a lot of -- when we are pumping 60 MW pump 320 CFS 2000 feet straight up, there are not a lot of other units like that in the world, 80,000 horsepower units.

MR. WOODWARD: Right, small ones.

MR. ZASSO: Small ones.

MR. WOODWARD: How big is a pump like that? We are sitting in a room, how big --

MR. BUI: It --

MS. ZASSO: About five stories.

MR. BUI: It is a four-stage pump.

MR. QUALLEY: 65 feet tall.

MR. BUI: Yeah. In this room, probably, not enough room for the unit here.

MR. ZASSO: One single unit probably fit with all of its (indiscernible) if you probably take this room up into a five story straight up.

MR. WOODWARD: Thank you. That helps a lot to get a sense of scale.

MR. BUI: You can walk into the about easy. You can walk into it, probably have room to spare too.

MR. ZASSO: Those units have been started twice as an induction motor in the life of the project as a test, not as a routine

operational event, but as a test. Each time Edison told us not to do that again because it does have a big influence of the grids.

Again, where it makes economic sense to replace with new and improved, we do that. Where it doesn't for unique pieces, we try to manage what we have, again, in coordination with our water pump directors. What makes best business sense for that piece of equipment.

MR. KLEIN: About the pumped storage, the capacity that is built into the system that your slide was leading to.

UNIDENTIFIED VOICE: You mean the presentation?

MR. KLEIN: Yeah, let him get done. I think that is a great idea.

MR. TRASK: Yeah, the presentation.

MR. KLEIN: Thank you for answering all of our questions. This is very very helpful to learn about this.

MR. BUI: The next to smallest of the three generation plants up in the Oroville Complex of the Thermalito Diversion power plants is basically located on the left abatement of the Diversion Dam. A very small unit, about 3 MWs or

so with a flow capacity of 615 or 620 CFS. It is primarily used for Hyatt Thermalito station service, and 3 MWs is not much at all.

Then there is the Thermalito Power Plant. You have both pump and gen. There is four units total. One is conventional generators, and the other one is a pump gen. Capacity is about 120 or so MWs with a 17,000 CFS capacity on water. Pumping, we have three units, and about 9,000 CFS flow at the plant.

MR. BROOME: May I make some comments?

MR. TRASK: Sure.

MR. BROOME: I would just like to comment on the presentation and discussion we've had. I've really done my career. I am 80 years old, I am not looking for more work, however, I am concerned with what I see as underutilized investments, and I do feel that the State Water Project has done an admiral job. I have nothing but admiration for the fantastic system that you have built and operating very effectively, but I think it has a little spare capacity, in fact, a lot of spare capacity, which if either industry or the public wish to duplicate, they would have to spend a billion dollars to create.

You have an incredibly valuable resource that I don't think you are using to its maximum capability. I have been in conversation with several people in your office, and the last word I think I had was from Steve Kashawata. He called me some years ago, and he said, well, the reason we don't actually operate the pumping and generating plants in a daily manner, is that we really can't account for the difference between what we use in pumping and what we recover in generation, like 25 percent loss, and how do we account for that. I was left speechless because that is the situation ever other pumped storage plant that has ever been built, and it is designed to overcome that loss of power by increase in value.

If you look at your project from a totally different perspective, profit making, making money, then you would do it very differently. You are not there to make money, I understand that, you actually spend money to operate your system.

MR. QUALLEY: There is a tremendous number of constraints on the operating. Tuan will get into those a little bit more --

MR. BROOME: I quite understand that you do generate with whatever water you release, you know, on a seasonal basis, but the capacity that is not used is a daily money-making operation to turn cheap power into more valuable power.

MR. TRASK: Ken, are you talking specifically about Oroville?

MR. BROOME: Oroville, Thermalito, and San Luis, all three could be utilized daily in this mode. Wouldn't use any water, it is just moving it up and down. It is not in any way reducing your main mission in life, which I was interested to see didn't mention the word energy, which is a given that you use energy basically.

MR. ZASSO: Our main mission, the department's mission is to manage the water supply.

MR. BROOME: I understand that, but on the other hand, you are a custodian of public investment. The public has paid to build this plant, this whole system, and it is for that one purpose of delivering water which I fully understand.

MR. BUI: I appreciate your comment, Ken. Let me go through some of the constraints on

the system. As I go through, I will point out that there are constraints on the system. Within the constraints of the systems, we try to do as much pump back as possible as we can.

Let me continue that. Your comment is noted.

MR. TRASK: We can continue the discussion after --

MR. BROOME: One other thing I would like to mention is that I do understand that you are ready to provide emergency generation when necessary. The ISO operator told me on occasion he has the right to use your plants in an emergency, which is great. I think that is wonderful. On the other hand, I will say that you are missing an opportunity to make money to repay some of the debt that the public has incurred --

MR. ZASSO: It is being repaid by the state water contractors.

MR. BROOME: Yeah, I mean we suffered terribly during the power crisis in 2001/2002, the build up was huge obligation. You could recover some of that.

MR. ZASSO: The ISO routinely requests and makes out of market for other generation out

of our system. We have the right as the generator/owner to operate our system within our operating parameters, and at times have been asked by the ISO for something that we cannot comply with because it will not fit within our operational constraints.

MR. BROOME: Sure, no, I understand that.

MR. ZASSO: Again, we are dispatched by the ISO, but we will operate our system within our operating parameters and regulatory requirements, not the ISO's.

MR. WOODWARD: Let's let them tell us about more of the constraints. Your point is well noted, Ken, that there is potentially the ability to push water back up and let it run back down again to help generate some additional revenue, so let's see what else they are constrained with because I don't know what they are constrained with yet.

MR. BROOME: I did check some of the constraints, and it is important. It is not built for the purpose of just generating money. It is built for water, and there are some limitations, but the reservoir capacitors, for instance, at San

Luis are such that the range of head in the lower reservoir can be accommodated and maintain a constant flow in the canal.

In other words, there is no reason to interrupt the delivery of water in order to change the level of reservoirs at San Luis between the lower and upper reservoir, it can be done.

The only other thing that is missing from a typical pumped storage pump plant, is the regulating veins on the turbine, and that is because you never envision having to control frequency or voltage which typically is typical in commercial pumped storage project does, and they can claim ancillary benefits by that provision of frequency and voltage control.

That could be added, but it doesn't matter because they are designed for maximum generation capability which is fine, you don't have to add that, but it could be done.

MR. WOODWARD: No dispute that it could be, I want to hear more about what the system looks like, and we will continue the discussion of options in a little bit, okay?

MR. BROOME: I'm sorry, I'm a bit hard of hearing, this 80 year old.

MR. WOODWARD: We would like to let these folks continue the discussion that they've started, so that we can finish learning what they have to tell us today, and then we will continue the discussion of options a little bit later.

MR. BROOME: I do have a suggestion actually, it might even interest the businessmen here that we could overcome the problem of mission of responsibility and risk taking, all of which is a business issue. So, I can add that later.

MR. WOODWARD: Thank you.

MR. ZASSO: I appreciate it, thank you.

MR. BUI: Some of the constraints that I put up there are basically weekly considerations when you do your schedule, you know, generations pumping for the State Water Project.

The first one is water supply requirements. I am not just talking only the water supply to our own contractors. I am also talking about the water supply for the people, the voters of the afterbay also.

Basically the typical generations that are higher during the peak summer times are between 15,000 to 30,000 acre feet per day, with the capacity I mentioned earlier at the 30,000

acre feet per day, you pretty much generate all the hours available during the on-peak hours and some during the off-peak as well.

Another constraint we have to consider basically is the Feather River in-stream flow requirement. There are in-stream requirements that you have to maintain, (indiscernible) agreements that basically you have to maintain 1700 CFS I think from October through March and then 1,000 CFS from the remainder time of the year.

These are changes. There are provisions in the requirement, but basically it depends on the year type, you can actually reduce those requirements. However, most of the time due to recent high flow in the system and so on, the river is kind of move, so even though the requirements let's say 1,000 CFS, people downstream (indiscernible) water to irrigate their system cannot get the water in because the river beds have moved and so on. So, we actually have to release water higher than the requirement to accommodate them downstream.

Water temperature requirement is another interesting animal where we have to consider

basically there are I can think of three requirements. The first one is the fish hatchery, the Feather River Hatchery, they like cool water. It varies, it ranges from 51 degrees to 55 degrees at different times of the year with the plus or minus about 4 degrees fahrenheit requirement.

We have another requirement for Robinson Riffle which is mandated that we have to maintain. This is six or seven miles downstream from the Thermalito Diversion Dam where you have to maintain 65 degrees between April to June time period in order to be in compliance.

MR. TRASK: That is for fisheries management?

MR. BUI: That is for fishery management.

MR. WOODWARD: They need much warmer water some of the year a little bit further down stream?

MR. ZASSO: Correct.

MR. BUI: Right. It is a different species.

MR. WOODWARD: It is not upstream, it would be really complicated to do.

MR. TRASK: That's 65 degrees maximum,

isn't it?

MR. BUI: Maximum, you cannot exceed that. This is six miles downstream, so basically, you have Kelly Ridge discharges water into the system with much hotter water. Let's say the flow is 1,000 CFS, Kelly Ridge discharges about 200 CFS of 70 degree temperatures, you basically have to scramble in order to discharge --

MR. WOODWARD: Lower the temperature.

MR. BUI: To lower the temperatures. Another temperature requirement that we basically have to meet is the rice diverter temperatures. They want warmer water during the growing season. Basically, you have two competing interests with different temperature requirements so you have to meet both of them.

MR. TRASK: I just want to go back to a picture of your system here to make sure I understand that. The warmer water is coming from the Thermalito afterbay, the rice growers.

MR. BUI: The rice growers, yes, would like to receive water in the warmer.

MR. TRASK: The other one that you mentioned that was 200 CFS where is that coming in?

MR. BUI: Kelly Ridge, it is right. It is entering right below the discharge of the Hyatt Power Plant.

MR. TRASK: Then you just release through the power plant, through Hyatt to mix that to meet your temperature?

MR. BUI: Yes, and Robinson Riffle is right about there somewhere. We have water temperature requirement here for rice grower which is warm water they desire, cooler water here for the fish, cooler water here also for the fish hatchery, and we have water entering into our system from our own facility which we have control of the temperatures.

We also have water from Kelly Ridge entering our system here which we have no control over. Basically it is juggling act to meet temperatures. At times, we have to bypass our own generation, especially in the dry years. When the reservoirs are down, we don't have much of the cool water pool left, and the requirements are basically right around April to June, yeah, right around that period when things start heating up.

You have to bypass generation, take the water right out of the bottom of the reservoir in

order to meet that. I believe in 2003 or 2002, we had to bypass the water in order to stay in compliance.

MS. NEWMARK: Do you have spillways or outlets at different elevations on the dam?

MR. BUI: We have intake structures that basically be able to take water at the different level, however, the system is the shutter system. Basically, whenever you take the shutter out, at that elevation is the water entering in and all the water above it. So, there is grizzly that we can put down and then make a space down there.

As the temperature heats up, you take shutter out, try to release the coolest water you have in the system, however, you have to kind of manage the cool water pool a little bit because otherwise if you send all the cool water out during the first early months and you run out of cool water pool, you are basically forced to bypass all the generation that you have in maybe June or July period.

There are a lot of things that you have to consider at the time. You have to eliminate generations, at times you have to eliminate pump back. At times you have to go and negotiate with

Fish and Game to make sure that water is still that's what they want. It is --

MR. TRASK: What are the factors that would limit your pump back?

MR. BUI: Temperature requirements are one of them. Economic sense is another one. Basically, you have to have enough price differential.

Let me go through this. The next slides will be the pump back constraints. Note the water quality and water quantity requirements in the Delta is another very very important aspect of our operations.

Water quality is decision 1641 by the Water Board. You have to comply by that. The Endangered Species Act, it came in the form of how much out flow you have to release into the system and how much water quality as far as electrically continuity that you have to maintain a certain station in the Delta.

Be it if it is water quantity that you have to release out in the river, you, in coordination with the CVP, the Bureau of Reclamation, you have to maintain the integrity of the Delta before you can export the water. At the

time, you have to release the water for the Delta compliance.

MR. TRASK: It is salinity monitoring station is dictating how you have to release?

MR. BUI: Yes.

MR. BROOME: May I ask a question about that? Is there any restriction on interchange between the Oroville Reservoir and the Thermalito afterbay? In other words, there is not fish in that section.

MR. BUI: Through the power canal, there's no fish. However, the Thermalito afterbay, there are elevation restrictions due to brook ponds. We put brood ponds into Oroville for water fowls. At a certain time when they are nesting season, you cannot fluctuate the --

MR. BROOME: You could release from the afterbay at Thermalito into the Feather River continuously without regard to the interchange between Thermalito and Oroville.

MR. ZASSO: We do. We release --

MR. BUI: We release there.

MR. ZASSO: -- from Thermalito afterbay through the river outlet 24 hours a day.

MR. BUI: Yes. Okay. Then there are

different times of the year basically you have flood control space like I mentioned earlier. The first three and last three months of the year we pretty much depend on the type of year we are in flood control mode.

Another one is afterbay elevation restrictions. These are the brood ponds of the ducks when they are migrating ducks, and they are nesting in the afterbay. It is an ideal spot for them. Once they nest, you have to stay away from flooding their nest, otherwise you are going to destroy all of the nesting there.

Also another species, which is the grebes, what they do is -- the brood pond is from March through June, the grebes is from July to August, so basically, you eliminate that peak season there. While the grebe is nesting, the nest of the grebes is already established. You have a elevation restriction of three feet to operate. It doesn't matter what elevation you are at, three feet, plus 1 1/2, minus 1 1/2, that is the bend of elevation that you have to work with.

You know, of course we optimize our generations based on the fluctuation of the afterbay, so you would release water as much as

you can during the week, and then bring the elevation up at the higher level, and then Sunday you don't generate because, you know, low demand. You release water from the afterbay to the Feather River in order to maintain the uniform flow.

If you restrict it, that elevation fluctuation you limit the ability to do pump back, do generations and so on.

Power requirement is another consideration we do. We have to do a lot of on-peak pumping also. Some of our power generations are to meet our own lows when the price out there is too high to purchase.

MR. ZASSO: It is a source for our pumping sink if you will.

MR. BUI: Yes.

MR. ZASSO: We are generating here at a pump here and moving it through the transmission grid.

MR. WOODWARD: Your job at that level is to minimize the cost of the pumping based on selling generation and during peak.

MR. ZASSO: Right, we are using our own resources.

MR. BUI: The next slide would show the

pump back constraints. When we do pump back, we basically -- there are three factors that we have to consider, economic factors. Well, the price differential between on and off peak must be there and justify the lasting efficiency and pump and gen cycle. It must be enough to justify the wear and tear on the unit itself.

MR. TRASK: Just to back you up there, do you know of the cost figure, what spread do you need between on-peak and off-peak?

MR. BUI: I don't have that figure handy with me, do you? It's been in the POC, the people that actually do the trading, they have a rule of thumb of how much differential is there to justify the loss, the difference in generations and pumping cycle and also the wear and tear on the units as well.

MR. TRASK: I know in general, most pumped storage you only get back between a third and a half of what you pump up, is that consistent?

MR. BUI: That's sounds about right.

MR. ZASSO: My recollection from last time that we pumped back for economic reasons. If you want to purely pump back, the differential was in the neighborhood of $20 or more. Would that be

the same today, probably not. That was several years ago, but as I recall, that was the spread that we were looking at for that.

The temperature requirements as Tuan identified has become somewhat restricted, but it is pretty much precluded us from doing a purely economic pump back operation of the Oroville Complex.

I mentioned earlier of our condition assessment program that we are undertaking within our whole project. Part of that is to work more detailed at the cost of unit starts, which would again key in to what is the economic differential that we need in order to make that economic (indiscernible) operation.

MR. TRASK: I guess I am not quite clear. The temperature restrictions, is is because the water is actually heated up when you pump back up?

MR. BUI: Yeah, go back to there's a schematic I can -- the water is being pumped, being generated from here, travel on down to the Diversion Dam, on down to the power canal, entering the forebay, and then being generated at the afterbay, and then entering through the

pumping plant and then you know taking residence in the afterbay.

The compliance point is here. When you do pump back -- yeah, and up here too. When you do pump back, what happens is you are stuck in this warm water, a large amount of warm water back up this way and enter this small body of water where it mix with the cool water released from here and then travel on down to the river because this is a low flow section, you have to maintain the 600 CFS also during this stretch.

MR. WOODWARD: At the colder temperature?

MR. BUI: Yes. If you do pump back, you are bringing warm water back to this body and then mixing it with the cool water and release the water down here. So, that is where you are running into a lot of compliance problems. We found by eliminating pump back, we can better meet the compliance of this temperature station here.

MR. WOODWARD: The compliance is binary, either you are in it or you are not.

MR. BUI: Right.

MR. WOODWARD: If you are not, you get yelled out and fined and all sorts of other stuff

goes on.

MR. BUI: It is mandated. I don't know what --

MR. WOODWARD: It is not pleasant to be told you are out of compliance I am assuming.

MR. ZASSO: The hatchery temperatures are established as part of our long term contract we've had with the Department of Fish and Game for fishery management. I believe that contract dates back to 1963. The Robinson Riffle I believe is set up through NOAH --

MR. BUI: I believe, yeah --

MR. ZASSO: Fish and Wildlife Service --

MR. BUI: Fish and Wildlife Service as part of a biological opinion on salmon and other fisheries in that area. That is a fairly new one over the last four or five years. So, yes, there are regulatory requirements.

MR. WOODWARD: It is a requirement, you don't have an option in it --

MR. ZASSO: No.

MR. BUI: No. Basically, there are options. We put chillers at the fish hatcheries in order to meet some of the temperature requirements, and we regularly have to pay

attention to it.

MR. WOODWARD: I think if chillers is the sort of stuff used for air conditioning systems, is that sort of what --

MR. BUI: I think it is similar to that, I don't know exactly.

MR. ZASSO: The chiller operation at the hatchery, it is a very small portion of the hatchery operation. The more onerous is the Robinson Riffle and the other water going into the hatchery, the hotter the water going into the hatchery, the more energy we have to use in order to get it chilled down for hatchery operations.

If we manage for those requirements, for both of those requirements, then --

MR. WOODWARD: You certainly can't push water back up to the pump. You can't head back to Lake Oroville. Either you get all the way to Lake Oroville and pray, or you stop before it gets to that pumping station. It can only go to the --

MR. BUI: That is defeating the purpose. You basically generate -- let's say you have limited fuel, it is a dry year, and you don't have much fuel, so you do pump back. You generate and you pump the water back so that you don't waste

your fuel.

If you cannot pump the water back up to here and pump it up into Lake Oroville, so you can generate the very next day when the power is needed and energy price are high, then basically the water is ending up right here, not much at all. The generation there is about 120 MW. Up here you have about 800 MW. So, it is designed to operate in tandem, in the pump back operation, you basically have the Thermalito pumpback travel through the power canal, put back into the (indiscernible) of the water and then from there pick up from Hyatt and put back into Oroville again. So, that is a cycle. You pump from one, and you travel it on up.

I have some slides that basically showing the time that more frequent that we do pump back and with less restrictions and with the restrictions that we can live with, but it is doing the first three months and the last three months of the year.

During the summertime, it is difficult because for one thing, if you release about 30,000 acre feet through your system, you take up all of the available capacity during the on-peak hours,

so you don't have any room to generate in addition to what you are scheduled to release for Delta requirement, water requirement, in stream requirement, all of those requirements.

If you do pump back during at night and then generate at night, it defeats the purpose, you know, you have not gained anything yet, so you have to find windows in your system that allow you to do pump back, and we do this on a weekly basis, daily basis, that is what the dispatchers are for. They basically evaluate the situation and then do the planned pump back.

MR. ZASSO: One other facet of our daily schedule at the Hyatt Thermalito Complex is that we are also involved in the ancillary service market with the ISO. With providing both regulation up, regulation down spin, non-spin.

Regulation alone, we will leave a minimum amount of generation during the night time hours to be a part of that ISO market and system. We also have self-provisional requirements that we have to provide as part of pump flow.

The majority of our pump flows at night, so we have a set requirement that we have to comply with as far as the all the generic WECC and

ISO requirements for that pump flow.

MR. TRASK: In other words, you could take power to do pump back at night, but you actually probably need that for your pumping stations way down the line --

MR. ZASSO: Our ancillary services --

MR. TRASK: It is still probably cheaper for you to self gen and supply your own load than to --

MR. ZASSO: Right. Additionally, the way the Hyatt facility is constructed, there is only two pin stocks there. As far as I know to my knowledge, we don't pump and gen at the same time. We are supplying ancillary services, self complying either for us or bidding into the ISO market as part of the ancillary service, we are most likely not going to pumping at the same time and doing that. We are going to try to maximize our energy portfolio that way.

MR. WOODWARD: Even if you had another pin stock, you would probably still use it to sell in the ancillary market because it is more valuable?

MR. ZASSO: Most likely.

MR. WOODWARD: All right, I understand.

Given the constraints you've just described as going through the crook there to get back to the dam, you would almost be better off having a separate passageway that wasn't interfering with your temperature control if you were going to do more of it. You are already doing it some months of the year anyway when you are not in peak generation conditions --

MR. ZASSO: Right.

MR. BUI: As you can see, the next few slides -- can you go back to the slide --

MS. NEWMARK: With respect to pump back, right now you are taking warmer water and sticking it back behind Oroville Dam and the lake, right?

MR. ZASSO: Right.

MS. NEWMARK: Do you have concerns with over turn --

MR. BUI: Quantity is --

MS. NEWMARK: Quantity is not an issue because you are moving so little water?

MR. ZASSO: Right.

MR. BUI: Right. It is little water compared to the model of the lakes basically. You don't have a thermal (indiscernible) issues that you have to worry about pretty much.

MS. NEWMARK: Thank you.

MR. BUI: I mentioned the economic justification, the water temperature requirement that you have to maneuver before you can do pump back. Another one is Thermalito afterbay elevation constraints. Basically, I mentioned earlier the water fowls, the brood ponds that we put into the afterbay and also the new grebe, basically restricts that peak window that try to fluctuate the afterbay.

MR. WOODWARD: Again, what I am hearing is you say is it is primary summer months.

MR. BUI: Yes, --

MR. ZASSO: That is when they are migrating.

MR. BUI: That is when they are migrating.

MR. WOODWARD: You've got six months of the year where you have the ability to do a bunch of pump back and six months where you don't have anywhere near the same ability?

MR. BUI: Right. If you go to the next slide, basically, here is the typical Lake Oroville operations. We fill about May or so, June or so, and then we drain again during

September.

MR. ZASSO: For water supply and other regulatory requirements.

MR. BUI: It's a typical cycle that we operate, dry year/wet year, the lake of course is lower during the dry year, wet year plentiful. We fill it up and then we drain it.

There are a few elevations that I kind of pointed out. Basically right about this elevation, about 731 feet, you basically lose higher pump units. You cannot generate it because of excessive vibrations. It is out of the efficiency zone. You just don't do it. It is going to shake itself out of the --

MR. ZASSO: As we said earlier, these units vary with capacity, these units very with lake elevation. We got down a couple of years ago, we got down to where a pump turbines in generate mode had a range of about 10 MWs because of the head that's on the units. We just cannot physically get anymore out of it.

MR. BUI: Yeah. I think it is either 2002 during this period here I think it is in October of 2002 or September of 2002, that is when we actually have to use a river valve to take

water out of the lake. The river valve is at the regional bypass that we put it in before we they built the dam to divert that. So, we had to take the water out of the lake to supply to meet the temperature requirement, bypass generation.

The next elevation that I would like to point out is basically 740. We just pump turbine generation limitations. At that elevation, you are not at full capacity that you designed for, it has been derated.

At 750, the pump efficiencies are basically really decreasing.

MR. WOODWARD: They are in the 90's normally, and now they are much lower?

MR. ZASSO: Much much lower.

MR. BUI: Much lower.

MR. WOODWARD: The curve drops off?

MR. BUI: Yes, basically the curve dropped off.

The next -- well, this is the projection -- is this the 90 percent exceedence that you poured in here. We anticipate to fill some time in June of this year, and the cycle begins again. We are going to drain the water back down, water quality requirements, water

supply, instream requirements and all of that, it will drain the water back down.

MR. WOODWARD: The only reason you wouldn't drain down as low as if it is relatively wet through the summer, then the Delta doesn't need its salinity issues and you don't have to spend as much water keeping that up.

MR. BUI: Let's say it is 70 degrees in Los Angeles or the Central Valley. Basically, we have the water to delivery. If we don't have demand, basically, it is going to stay in Oroville.

We try --

MR. WOODWARD: If it gets to 90 degrees, we all have trouble, and you've got to start shipping water.

MR. BUI: Lawns need to be watered.

MR. ZASSO: Crops need to be irrigated.

MR. WOODWARD: Yeah, I'll go for those. That lawn thing, I'm not sure I want to agree with yet, but I'll accept that is the current demand.

MR. BUI: The next slide will show basically, this is a 2000 -- I didn't have time, I put this in rather quickly. I should have done some recent year as far as pump back pattern.

This is 2000 of the Oroville Complex pump back operations. I don't know if you can see there is a blue and a magenta. The blue is a higher pump back, and the magenta is basically Thermalito. As you can see, they are designed to operate in tandem.

So, like I mentioned earlier, during this period here, we tried to find windows of opportunity to do pump back as much as we can, but the majority of the time that we do pump back during the last three months of the year and the first three months of the year, basically winter and then fall. Those are the periods --

MR. TRASK: Can you explain what happened in June there?

MR. BUI: I don't know what happened in June there.

MR. ZASSO: My guess, and it is a guess either that was a system disturbance that precluded us from moving energy from north to south, and instead of selling it off for pennies on the MW, we most likely within our temperature requirements and operational requirements probably put some pumps on to use our energy that we had already acquired and was most likely bringing in

through from the Pacific Northwest.

MR. WOODWARD: That was actually the window between the grebes and the riffles, right?

MR. ZASSO: Yeah, pretty much.

MR. WOODWARD: One vacated, and there was a couple of days of movement --

MR. ZASSO: If you notice, it was very short duration too.

MR. BUI: Yes, very short. I mean it is probably a couple of days there or something.

MS. PARK: How come that is funny? That's June 2000, that was the start of the California (indiscernible) --

MR. QUALLEY: That is when they had the spike where the generators were testing.

MR. BUI: Even with a high price, you really, you know, can't do it during this period. There is too much constraints --

MR. TRASK: 2001 was fairly similar?

MR. BUI: Similar, yeah, it is probably similar. If you have a lot of releases out of the system, then basically you are running out of your capacity window during the on-peak hours to generate, you know.

The next slide I believe that is I am

turning it over to Tio, and Tio will go over the San Luis Joint-Use Complex, so here you go Tio.

MR. ZASSO: Again, our San Luis facility is a joint-use facility. It is co-owned by the department of the Bureau of Reclamation. That includes generally pumping and generating plants, San Luis Reservoir and O'Neil Forebay. Also Dos Amigos Pumping Plant and also the California Aqueduct between pools 14 through 21.

The San Luis Reservoir itself is roughly around 2 million acre feet with the DWR share just a little bit over a million acre feet. The Bureau is about 965,000 acre feet.

The pumping generating plant was designed and constructed by the Bureau of Reclamation. It was completed in 1967, and again, we operate it in coordination with the Central Valley Project operations of the Bureau of Reclamation.

It is the primary facility for moving water in and out of San Luis Reservoir for both this SWP and the CVP operations.

When water is moved from San Luis through Gianelli to O'Neil Forebay, that is where the California Aqueduct begins again is in O'Neil

Forebay. For federal contractors and pools 14 through 21 and our state water contractors, we move water through up the California Aqueduct.

Additional water, especially in the summertime in the peak, is moved through the Bureau owned O'Neil Pump gen plant back into the Delta Mendota Canal. We are actually providing water from San Luis to the California Aqueduct for both federal and state contractors and to the Delta Mendota Canal for federal contractors.

MR. WOODWARD: Can we go back to this map of the state, so you can point to that. Thank you, I'm just somewhat clueless on where all of these things are, so it helps.

MR. ZASSO: Okay. San Luis is right here. This is the California Aqueduct. In this section of the California Aqueduct, it is a joint-use canal. There is both federal and state water co-mingled. All the turn outs for agricultural users in this stretch are primarily all federal. We don't have any turn outs for the state. The state picks up downstream here. This is all state from here on out.

In this stretch right in here, there is a parallel canal, the Delta-Mendota Canal which is

all federal. Her is San Luis right at the apex of San Luis and the aqueduct is O'Neil forebay. That is the main transfer body if you will. It is about 40,000 some acre feet. Water from the Delta here is moved into O'Neil. The Bureau can't pump up into O'Neil or generate from O'Neil into the Delta-Mendota Canal.

In fact, how the Bureau fills their share of San Luis is that they pump from the Delta through Tracy Pumping Plant, through the Delta-Mendota Canal, and then pump up into O'Neil through the O'Neil Pump/Gen Plant, and then we take it from there using their share of San Luis of the Gianelli Pump Gen Plant.

We will be moving again in the peak time of the year. We are going to be moving water from San Luis, not only the feed demands along the California Aqueduct but also augmenting the demands on the Delta-Mendota Canal. It is not all of the Delta-Mendota Canals demands, but it is a good portion of it.

MR. TRASK: Is the Delta-Mendota larger --

MR. ZASSO: No, it is smaller.

MR. TRASK: Okay.

MR. WOODWARD: That ultimately goes to the CVP which runs down the east side of the valley --

MR. ZASSO: Correct.

MR. WOODWARD: Okay.

MR. ZASSO: Does that answer your question?

MR. WOODWARD: Thank you, very helpful. I just didn't know where we were talking about.

MR. ZASSO: The slide says San Luis PGP yearly operation, the next one. We have basically two modes that we operate San Luis in. Part of the year we are in -- from mid April to late fall, facilities operate in generate mode, delivering water from the reservoir for both DWR and the CVP.

Mid April historically begins Delta export curtailments. There is not a lot of water in the Delta, we've still got demand, that is when our demand starts picking up. It will add San Luis water in with our Delta water coming in for delivery to state water contractors.

Typically, we will generate between 10,000 to 20,000 acre feet per day during the peak summer months with some off-peak generation needed to meet water supply deliveries. We have certain

operational ranges within our canal, but the level of demand that we have, especially in the peak time of the summer we are going to be filling up our on-peak generation for both us and the Bureau, Central Valley Prop Project, and most likely generating into some of the shoulders and potentially into the off-peak in order to meet those deliveries.

The maximum we've ever delivered out of San Luis Reservoir for both projects combined is in excess of 20,000 acre feet, and that was several years ago. We moved 2.3 feet out of San Luis in one day. That was 23,000 acre feet and change. That is a lot of water, and that was pretty much around the clock. There was no room from pump back at all during that period. We were filling up generation only.

MR. WOODWARD: TAF is 1,000 --

MR. ZASSO: Thousand acre feet.

MR. TRASK: Not trillion.

MR. WOODWARD: I just wanted to know what the "T" stood for.

MR. TRASK: Tio, during that time, I would assume then that the actual water coming down to San Luis was --

MR. ZASSO: Minimal.

MR. TRASK: -- very cut back, okay.

MR. ZASSO: Minimal. Rate fault mid April. The facilities operated in pump mode. Again, we are trying to fill San Luis each year the water supply. Not only for the State Water Project, but for the Central Valley Project as well. So, we are taking it down to a minimum, say 300,000 or 200,000 acre feet and trying to get back up to 2 million acre feet by mid April.

MR. WOODWARD: That is sort of on-peak and off-peak pumping if you will, very seasonal.

MR. ZASSO: Very seasonal if you will, yes. The water is there. If we don't have demand for it, the water is available in the Delta to move, we are going to move it and park it in San Luis. Again, that's for future water supply.

Next slide please. At Gianelli we have the facility as constructed with four pen stocks with two units for each and water is either pumped or generated between San Luis and O'Neil forebay as we discussed. It is connected to the grid at Los Banos sub with two 230 KV lines.

There are eight pump turbines there. They are all francis type. They are dual rotor

design, which means they actually have two rotating rotors up there. One stater, and they will either run at 120 RPM at lower reservoir levels or at either 150 or 156 at higher reservoir levels.

The gentleman was correct earlier, there are no governors on these units, they are either on or off, actually the shut off from the reservoir are butterfly valves. They are either on or off. There is no -- we do not provide any regulation up or down or any spin at these units either. We do bid in occasionally, do bid non-spin in at San Luis because then we can dispatch that ourselves.

MS. NEWMARK: What are the nominal head differentials or the elevation differentials between these two bodies?

MR. ZASSO: Let's see, that's a good question. Max elevation at San Luis is about 500, and I am thinking --

MR. BUI: Yeah, I am thinking about in the neighborhood of 300 --

MR. ZASSO: -- about 300 feet of differential.

MR. TRASK: How quickly can you crank up

generation?

MR. ZASSO: Within ten minutes. Non-spin requirement, I believe we have to have the unit on line within ten minutes I think.

MR. TRASK: To maximum power.

MR. ZASSO: Yeah. The two units that have the 156 RPM rotors installed are actually our high head units, and those are used for increase pump efficiencies at the higher reservoir levels for fill operations. I will have a slide later that will go through the numbers on efficiencies throughout the range of the reservoir. Again, as with high head, they vary with reservoir level.

There are some operational limitations for mode changes from generation to pump or pump to generation. It is approximate one hour each mode change to reconfigure the bus electrically and to allow the motor generator windings to cool.

Over the last five or six years, we've had an on-going program at Gianelli inspecting our motor straps. We had a failure back in 2000 on one of our units to where a strap came loose and it basically torched the unit for almost a year while the redesigned the strap arrangement and

came in with modifications. So, we have been systematically inspecting our straps and as annual maintenance outages, which I am involved in, in setting the time for operations going through and making repairs and design changes on those units.

MR. TRASK: You have to physically reconfigure your switch gear?

MR. ZASSO: The operators have to go in and change, to go from one mode to the other, yes. Whether it be mechanically or remotely, they can do both, but they still have to some time to do that.

At certain reservoir elevations, changing from mode from either pump to gen or gen to pump may require a rotor change as well. There is a certain range around mid reservoir level to where in one mode you will be in the 150 or 156 RPM, and the other mode you will be in a 120. It is just a characteristic of the particular units.

Next slide please. This is a cut away. Again, the old name was San Luis Pump Gen when it was designed back in the 60's. Again, here shows the dual-rotor configuration. The pump set center line here is roughly around 200 feet, and then is here the discharge or the shut off valves here.

The next slide please. This shows our yearly cycle, very similar to what you saw for Oroville. Again, we are always trying to top it off by mid April. We historically have Delta curtailments that begin in the spring time that we are limited from moving water from the Delta. So, we are always trying to target 2 million acre feet for both projects.

At that time --

MR. TRASK: You are very consistent it looks like.

MR. ZASSO: That is our target. This is water supply. This is water supply for 20 million Californians and 900,000 acres of farm land in the Central Valley.

MR. TRASK: Compare it to your operations in Oroville, which were variable season to season, even in dry years, it looks like you are able to fill San Luis or almost fill it in every year.

MR. WOODWARD: You don't have a choice if I am understanding right.

MR. ZASSO: That's correct.

MR. WOODWARD: This is the requirement of supply in the water?

MR. ZASSO: That's right. If work curtailed out of the Delta, this is our next supply.

MR. BUI: Right. The reason you see is April period. We try to top it off like Tio said earlier. During April and May period, we have what we call vamped curtailment, it is (indiscernible) Adopted Management Program. Basically that is when the fish are migrating out to the ocean, so basically what they want us to do is curtail our pumping, provide extra flow to the system, so to help the fish migrating outward.

MR. WOODWARD: To leave.

MR. BUI: To leave exactly, a fish flush. So, we cut the pumping down in compliance with this program, then the other water supplies are basically at the same time water demand is picking up, so we supplement whatever we can pump out of the Delta, the water out of San Luis. So, you see right around April 15 to May 15, that is when the curtailment period, that coincides with the period that when San Luis is actually draining.

MR. ZASSO: Right. Again, certain years we hit it harder than others. This is probably

typically a fairly wet year when there was extra water in the Delta, we didn't have to take it down as far. If you will notice, it is still similar curve, we are still -- we are maximizing our exports from the Delta as we are allowed to and augmenting it with deliveries out of San Luis.

I plotted some of the basic elevation curves here. At maximum, we get about 50 MWs a unit, 2100 CFS, gen, and then in the pump mode spurring that MW 750 CFS, that is why we have those two units configured for 156, pumping the other six units are very very -- the efficiency really goes down at the higher elevations. As you can see, those are almost double. It is 1600 CFS for those two units.

If you can pull the slide back a little bit and give you an elevation look. That is around 540 foot elevation. At 500, you are looking at about 40 MW, 1900 a piece, 45 and 1650.

Pumping wise, you are looking at 55 MWs for two units and 45 for the other six. We can generate with about 40. We have to use 445 and 55 MWs to pump with. That is just a characteristic of the unit.

At 450 for the elevation, all the

units -- again, we've had a rotor swap, and we are now in the 120 rotors, so you get about 30 MWs a piece, 1800 CFS. Pumping is about the same 1555. For 100 feet, we are down to 20 MWs, 350 feet, which we haven't gotten to in many years, but we did get down to the 400 foot back in '04. We are down here about 10 MWs. Again, it is a very very constant cycle throughout the year.

We try to maximize the Delta filling up by the early spring. We are using it for water supply for both the Central Valley and for Southern California.

MR. TRASK: How long does it take you to change a rotor out?

MR. TRASK: To swap rotors? We typically schedule that about an hour. Again, the same time. At the same time if they are going from pump to -- if they need to go from pump to gen, then that will be part of that same activity for that particular hour.

MR. TRASK: In emergency situations, they can swap faster than that, but we typically schedule that to allow the operator time to swap the systems down. That is still one of our manned plants. We do have some remote operated

facilities. This is still one of them that is manned. It also allows, again, all the windings and everything the coal before we swap to the other mode.

Going from pump to gen usually isn't the problem, it is going from gen to -- a fraction going from pump to gen is usually the more onerous one we have to let the windings cool a little bit more for that. Going the other way, generator tends to pretty cool in that mode.

MR. KLEIN: On this chart on the left side, it looks like at the different reservoir elevation levels, the generation capacity goes from 2100 CFS to 1900 to 1800, 1550, and 1100, but the pumping capacity seems to vary in a very different way.

MR. ZASSO: Yes, it does.

MR. KLEIN: That would effect the economics --

MR. ZASSO: Yes, it would.

MR. KLEIN: -- of your pump back opportunities quite a bit.

MR. ZASSO: Again, right in here you've got somewhere in this range in here, you've got a rotor change. The units do not like, especially

at the lower elevations, do not like to run in that 150/156 RPM range. It vibrates the unit, cavitates the units, we don't like to operate them in that mode. We have to go to the 120 rotor.

MR. TRASK: The vibration comes from the cavitation.

MR. ZASSO: And that lack of head. At this level trying to pump with, there's not a lot of head there. Any questions? Next slide please.

In conclusion, that is all I have on the San Luis facility. I would like to say one thing that when we are delivering for both the CVP and the SWP as I said before in certain times of the year, we are generating all the on-peak hours, we are generating most likely some if not all the shoulder hours, and potential even in to the on-peak to make sure that we can meet deliveries and operate our system within the normal operating criteria and requirements that we have.

MR. WOODWARD: That's the whole system, not just San Luis?

MR. ZASSO: Right, we operate the ditch every day within -- each pool has its own operating range. Each reservoir has its own operating range, each plant has its own operating

requirement.

MR. CROOKS: Excuse me, when you say they are operating at full capacity during all peak hours, is that what you said?

MR. ZASSO: For generating water from San Luis into O'Neil for delivery, we are going to fill up all the day time hours.

MR. CROOKS: I guess what I am referring to is where you said that I think you said generating on on-peak hours, generating electricity on all on-peak hours --

MR. ZASSO: At San Luis.

MR. CROOKS: Is that at full capacity?

MR. ZASSO: Typically, when we are doing that -- if you can go back to the slide of the reservoir level -- we are looking most of the time our peak deliveries are June, July, August. If that is April, we are looking somewhere in here, so we are typically not at full capacity when we are hitting our peak delivery time. That is the nature of our demand pattern downstream.

Our upstream supply is curtailed, our downstream requirements are going up. So, we are moving water in this period. So, if you are looking at June, July, August, you are typically

in this period right in here. So, we are down somewhat. We will fill up as the capacities come down, we will be filling up all of those hours as we need to.

MR. CROOKS: You dispatched it all based on price in the market. Is there a price forecast function within the department, and is there any dispatch on market price signals?

MR. ZASSO: There is. We will most likely tie that in to our ancillary bids, especially at San Luis. Again, we can't do any regulation of spin because of the nature of the characteristics of the units. We may have a non-spin bid in there for "X" amount at a certain market price.

MR. BUI: We don't have a grouping department for new forecasting, price forecasting, if that is the question you were just asking. We contract with other entities to provide us with the price forecast.

MR. JOHNSON: Maybe I can add. What is being done is that you are optimizing in this case as you are trying to minimize the net power cost over the year within the constraints of the water delivery. When you get to the San Luis Reservoir,

there are tighter constraints there than you would see at the Hyatt where you have the large afterbay. So, Tuan spoke about it earlier, there is a weekly pattern of releasing from Oroville into Thermalito so you get your generation in the on-peak hours, but then you have your cost and flow out of the afterbay into the river. That is an optimization there to get the maximum benefit from there. You are maximizing your on-peak generation and still have a constant out flow from the entire project.

When you get down to San Luis, you don't have that large of an afterbay and those other tighter constraints on that, that can limit what you can do.

MR. ZASSO: Our California Aqueduct has an operating range of around one to two feet per day, and at peak time of the year, you know, we are going to be moving. Peak month out of San Luis, we will move a half million acre feet. That is all going somewhere. It is either turn outs out of the California Aqueduct or downstream terminal reservoirs down in Southern California.

The bulk is coming out of turnouts along the California, so we've got to meet our demand

targets, identified by our water contractors and our users. We have to replace our water mostly on a daily basis because we have such a small operating range on the canal. That is, again, as we said earlier, that is to protect the integrity of the canal.

MR. TRASK: The canal just flows right into and right out of the forebay, there are no gates or anything --

MR. ZASSO: There is a gate structure there.

MR. TRASK: There is gate structure. In general, as you fluctuate the forebay, you are also fluctuating your canals.

MR. BROOME: Does the Bureau have any say so as to how you pump or generate at San Luis, or is it strictly a state decision?

MR. ZASSO: No, they have say so. They provide what schedule they would like each on a daily basis on a pre-schedule basis. Say today they are giving us what their schedule will be two days from now for the next couple of days after that.

MR. BUI: Basically, they fill up their share, and if they don't use all of their share,

we have the opportunity to use the capacity available. Basically, it is a correlation between the two projects. Our control rooms are basically separated by a door. You know --

MR. WOODWARD: It makes sense.

MR. ZASSO: Again, during the peak delivery time of the year, June, July, August, you know, they are using their percentage, we are using our percentage. We are filling up most of the day with generation to meet deliveries.

MR. TRASK: When you release, you are just releasing at your maximum rate all the around the clock. You can't release more during the day and less at night?

MR. ZASSO: We are filling up the day time hours at a rate, and we may shut particular units off at night if we need to back off a little bit. During the summer months, we are running the plant pretty hard.

MR. BUI: Tio, you mentioned about the limitation of number of stop at San Luis.

MR. ZASSO: Again, as I alluded to, we had a failure a few years ago of one of the (indiscernible) straps that burned up one our units. We are very cognoscente about the number

of pump starts that we have on those units.

During the fill time of the year, around this leg up in here, we will interrupt the day time, we will interrupt the unit for a day and let our maintenance staff get in there to do a fluoroscope and visual inspection on the (indiscernible) straps and make repairs if necessary. Last year I think we made repairs on two units during the course of our fill cycle here, which eliminated a potential catastrophic event. We are very cognoscente of the number of pump starts that we put on those units.

It is a water start. The units were designed originally for unwatered start, again, system design by the Bureau years and years ago and never worked, so the units were watered up or started up in pump mode watered up. So, it is very hard on the units.

MR. TRASK: You need motor generators here as well to start them up?

MR. ZASSO: (Inaudible).

MR. TRASK: No, you don't, okay.

MR. ZASSO: Breakers close, they start rolling.

MR. TRASK: And watch the lights go dim.

MR. WOODWARD: We have several questions here, Matt, and we are sort of at a lunchish time, but --

MR. TRASK: I was just going to say that, we are at 12:30.

MR. WOODWARD: I don't want to lose our folks from DWR. I suspect they actually only committed the morning to us, but we have some other questions that we would like to consider today, so if one or more of your able to stay, it would be very helpful even after a lunch break.

Otherwise, we ought to proceed.

MR. TRASK: I'm open as far as you're open.

MR. BUI: He drove here, so I am kind of like a passenger.

MR. WOODWARD: Let me recommend that we take a lunch break.

MR. TRASK: I like that recommendation. Can we do it in an hour? Off the record.

(Whereupon, at 12:33 p.m., the workshop was adjourned, to reconvene at 1:45 p.m., this same day.)

--oOo--

AFTERNOON SESSION

1:45 p.m.

MR. TRASK: We are now official again. Somebody just joined us on the telecom. Who is there?

MR. PARKER: James Parker.

MR. TRASK: Hi James, how are you doing? Matt Trask. We are just going to finish up here our discussion of State Water Project operations, specifically related to power generation. I guess I will just throw open the floor. I will note that in the study, the water energy relationship study, I was largely silent on pumped storage and other water system generation possibilities, largely because I only had a few months to pull it together, and I didn't think we could get any projects built in that time.

This could be the start of a longer term I guess at least a discussion group if not actually a policy planning group. If anybody is going to lead that, it is probably the two gentlemen up here at this end of the table since it is their baby, and they are actually Energy Commission people.

Gary, did you have any comments or

questions?

MR. WOODWARD: I want to thank everyone for this morning's discussion. I learned a ton of things and put a lot of thoughts into perspective, and that is very valuable. I don't know where we are going to go exactly on this specific question of pumped storage, but I do know as a state, we are looking for a way to store intermittent energy sources. Sun and wind sort of come to mind.

In relatively large quantities, we are talking about 10,000 MWs or more worth of the stuff.

MR. BROOME: How much --

MR. WOODWARD: About 10,000 ultimately sort of the rough numbers we are looking at in broad brush strokes about 4,000 MWs of wind in the Tehachapi area and the solar folks for large scale solar are starting to come out and talk with us, and there are several thousand MWs in the Mojave area. There is also a discussion putting geothermal on line down in Imperial Valley. That is a lot less intermittent if you will, but it is the intermittent sources that we really have to start thinking about.

So, to the extent that we are putting

that much on line, we would like to be able to soak some of its energy if you will when it is available and do something useful for the state. One of the obvious things is storage.

With that in mind, if the State Water Project doesn't necessarily represent the majority of the opportunity, all right. Don't feel bad here, we are all part of the same picture. We are trying to figure out where we ought to go focus our attention and help it happen.

We are basically for you all to put your feelers out and see who else do you know, whether it is your folks or others. We might have some in the way of storage. If it is storage water and it happens mean more flood control, super. Let's get threefors and fourfors out of project, right, it makes it pay better. We are sort of putting feelers out to see what's out there at this stage.

MR. TRASK: Yeah, Laurie with Hetch Hetchy, I know you have two reservoirs above Hetch Hetchy, there is no way to pump up to those, is there?

MS. PARK: (Inaudible) -- is a proposed pumped storage project at Cherry Eleanor. Basically what happens is because of the make up of the

water sheds that serve the systems, the left side and the right side are about equivalent in capacity of reservoir, but the water shed on the Hetch Hetchy side is more than three times the size of the water shed on the Cherry Eleanor side, with the result you tend to fill and spill in average years 2 1/2 to 3 times on the Hetchy side. On the Cherry side you have a risk of not filling.

Both for water supply and for summer peak pumping, for peak generation purposes, we had looked at taking some water out of the river on the Hetchy side, moving it back up the hill. They happen to converge right conveniently at the perfect point. Moving it back up the hill to Cherry, the problem is we are under -- I keep saying we. Hetch Hetchy is under Department of Interior permits. They are operating on federal lands, and there are some real complications to it because one of the arteries, the artery that home power house comes out of and discharges into (indiscernible) Scenic River, so there are many many challenges.

I mean there are opportunities like this. This would be a really valuable resource, but the hurdles to it are considered to be so

onerous that it just continues to sit on the books as a good idea.

MR. TRASK: Virtually anywhere you already have a reservoir, you could always add, even if it is only a tank, you could put in some micro-hydro pumped storage, but I guess what is missing, what I haven't seen anywhere is how could you analyze that from over the lifetime of a project. What does it cost to add pumped storage to an existing reservoir, what are you going to get out of it, especially with the variability and precipitation.

MS. NEWMARK: Matt, this is a study that one of my colleagues did last year. It's title is "Increasing Pumped storage in California by Linking Existing Reservoirs." This is a very high level GIS base. Look at pairs of reservoirs, and there are tables in the back where they are looking at El Pardo Comanche, and you will go through at (indiscernible), turbine cost, pipe cost using only public access, no private permit. Of course the line links are probably not optimized, but they are a good start and an idea of generation and cost per KWh.

It is a very course assumption, but it

went through and looked at a lot of potentials in our system, so I can give you a copy of that.

MR. TRASK: Great, yeah.

MS. NEWMARK: It is nowhere near the level of detail necessary that, for example, as we have learned, the constraints on actually operating in these systems that any of the operators know about, you have water release, you've got your turbidity which you don't have, but Hetch Hetchy has issues with turbidity.

They are all other parameters that would need to be assessed, but this is sort of a first cut at where the reservoirs, what are the lanes, what ball park are we talking about. It is actually compelling gross --

MR. TRASK: Right, but as you say, it is a good start. I haven't seen anything really.

MS. NEWMARK: I can send you electronically, but I might have it on my machine here. I can get it to you.

MR. QUALLEY: There was a project that you mentioned in the white paper. I don't really know anything about it, I was fascinated, the one down at Lake Elsinor where the water district is trying, and I guess they are in the

process of trying to get a FERC license for that. It seems pretty ambitious to get through all the regulatory hurdles on that one in that particular area, but more power to them if they can I guess.

MS. NEWMARK: Again, one of my colleagues had the idea of the expansion of Los Vallequeros Reservoir as an opportunity for this, and there is actually a gentlemen who has been talking to (indiscernible) mother's uncle I guess about it.

They identified a small canyon that is public access. I think it is within the water shed in Contra Costa Water District that it has the right capacity, and they looked at it as a potential. When you look at the Cal Fed expansion of Los Vallequerros, that might be an opportunity.

Of course, anybody who has to deal with just permitting Los Vallequerros doesn't want to deal with, oh, we will flood another little area. It takes a lot of intestinal fortitude I think to go forward with one of these projects, but it was an external driver to recognize the benefit of (inaudible).

MS. BURTON: The other part to that is (inaudible) --

MS. NEWMARK: Right. I'm sorry.

MS. BURTON: -- (inaudible).

MS. NEWMARK: It is in proximity to the intermittent source was excellent for that.

MR. TRASK: In my opinion, if we are going to get to a 30 percent renewable, we have to find some storage somewhere. There is just no other option.

MS. PARK: We have been talking about pumped storage, but one of the topics that I have not seen covered well has been the issue of repowering. You know, when we get into repowering, we get into the issue of RPS, which is, you know, a lot of the great untapped potential that we have right now are aging power plants, hydro plants where they could be upgraded and they could actually produce more, but there is a clear disincentive to do so because that incremental repowering if it pushes over the 30 MW limit does not qualify for RPS.

At Hetchy, we were blessed because we had a very creative engineer who was constantly trying to push the limits of what we could get out of the system, and through what he called tweaking the system while he was there, and actually he is

still there, the capacity of Hetchy increased on-peak from 360 MW to 405 MW now. That was really by tweaking, and he has often said that he would love to get his hands on some of the larger hydro projects and go in there and tweak for them.

If we use that as a benchmark, roughly ten percent potentially of the large conventional hydro units, you know, you could get 10 percent incremental capacity through repowering.

MR. TRASK: What is the nature of the tweaks?

MS. PARK: It has to do -- in the case of Hetchy, what he did was upgraded the generators and he changed out the turbine runners and did a bunch of other things with regard to the nozzles, you know, how they were directed so you got more efficiency out of the water. He is good at that. I don't think other people are looking hard enough at those options.

MR. TRASK: That was one things I was quite surprised with, both on supply and demand that generally you get a lot more out of an overhaul than you do -- let me get that right. You get a lot more out of an adjustment than you do out of an overhaul. That is whether it is an

adjustment in the pump or just your turbine adjustment in the prime mover.

I was really surprised that you got that much improvement just out of simply a few hours of work.

MS. PARK: It was a little more than a few hours, but as far as the investment and the upgrade, if I recall properly, we paid -- it probably cost about 20 percent what the cost of a new unit with equivalent capacity would have taken, not to mention you can do it in a very short period of time.

MR. WOODWARD: You also didn't need to do all the permitting and all the other stuff for a repower.

One of the questions that you are asking us to look at is what about repowering of the existing hydro infrastructure and looking at the question of what qualifies for hydro under RPS. Okay, those are important questions for us to consider.

MR. TRASK: DOE did a big -- Energy Information Administration did a big study of hydro potential nationwide. As I recall, there was something like 5400 MWs at existing facilities

getting more generation. The head's already there, everything is all there, you just whatever modifications to the turbine or added turbines, I don't know what the mix there was, but pretty big number.

MR. WOODWARD: In the pumped storage question -- I am sort of walking our way down this list of things for us to go through if we can. In the pumped storage case, it seems that there are opportunities in your contractors systems if you will as much or more than there might be in yours for storage. I was taught down in San Diego, I think I mentioned earlier, but they have identified bunches of stuff where they could move water back uphill. They don't have a facility in place, they don't have the pump or the generator in place on their line. They have a pressure reducer, pressure control thing. So, they could replace and they can get electric to it, you know, if they could figure all of that out.

In San Diego's case, where pretty much everything is either up or down, it is a pretty good place to look. I have trouble seeing how you do that in Fresno, for example, it is a whole lot flatter, but you know, you take the opportunities

where they are.

What do you guys think about that, how would we find out more, and how would you recommend we sort of talk -- who should we talk to, to figure out stuff like that, any thoughts?

MR. ZASSO: Wouldn't you talk directly with San Diego? It sounds like --

MR. WOODWARD: In San Diego's case, but now I've got 50 other counties, 58 counties or something like that, I've got to talk to lots of folks.

MR. ZASSO: Our primary contract down in Southern California is the Metropolitan Water District, and they already looked in their own system for water supply liability improvements. They built the Diamond Valley Reservoir down in Southern California. That is around 800,000 acre feet when it is maximum.

They put a pump gen plant right there at the bottom. They pump it up. Water comes from our system. They pump it up into Diamond Valley, and they generate it out when they need it.

As far as what you are saying, they are already on the forefront of doing that. Their facility is on the Colorado River Aqueduct, they

are pumping from lower up to higher. There is not much I am thinking they can do with that. They do have some small reservoirs in there, but those facilities are built back in the 30's, so I don't know what opportunity there is for them to do that, any pump back type of operation there. I know there is no facilities there currently.

MR. WOODWARD: Given the energy that is attached to water in Southern California, it sounds like we ought to go talk to MWD and the folks at SERVES because MWD is a contractor of the State Water Project, but San Diego is not. They are a user of MWD water.

MR. ZASSO: Right, they are one of the member agencies.

MR. WOODWARD: Right, so it seems like we actually have to do that. Given the way the numbers are looking from out statewide study, right, Matt, where it is so much more expensive, that is what you just showed us as well. We ought to start looking at the southern part of the state at the end of your pipeline if you will because every gallon we don't have to -- if we could figure out ways to save gallons or store gallons down south, it has great value for the system.

UNIDENTIFIED VOICE: You just said talk to SERVES, what would you talk to --

MR. BUI: No, the people that MWD serves.

UNIDENTIFIED VOICE: Oh, that serves.

MR. WOODWARD: The people that MWD serves, yes.

MS. NEWMARK: What about a few weeks, a month and a half ago, we heard the gentleman, I can't remember his name from Semitropic talking about what the small instream generation that they were creating in their system. That is an entirely different scale than that which we are talking about here, but again, if you do that locally, the extent to which you can with very small head --

MR. TRASK: I think that's one of the big advances too that may change this whole water system generation picture. Right now the assessments are rather modest. I think the only 200 MWs or so in the conduit right now, but there's been so much development lately in low head high flow and the reverse hydro that maybe we need to start from scratch.

MR. CROOKS: One of the things that I

ran into, I don't know if it is the right place for it, but looking at plants below 1 MW, low head hydro, the interconnection hurdles that exist with the serving utilities are completely subjective and almost insurmountable.

MR. TRASK: We hear that on the waste water generation as well. The digester --

MR. CROOKS: If these things don't loosen up, we can study these gizmos all we want, but until something changes about investor-owned utility access to the grid, it is not going to happen.

MR. TRASK: Well, we are the Energy Commission.

MR. WOODWARD: If that turns out to be one of the things we have to pay attention to is the interconnect issues related to any small scale distributed, in this case water.

MR. BROOME: I came across a case in point with the Semitropic Water Storage District where they were quite happy to think about 150 KW low head high flow installation on their canal, but only if they could use the power themselves.

The idea of selling it to a utility and then buying it back is no go. They have a

contract with PG & E that they buy it at one place only interconnection and that's it.

MR. WOODWARD: Right.

MR. BROOME: If they wanted to get a specific case, they would be happy to talk to you about that.

MR. WOODWARD: They have actually, but I guess one of the other things that sort of triggers is that Semitropic is a water banking district, so can water banking districts help the State Project?

MR. ZASSO: The flow is very small for us --

MR. WOODWARD: I understand from your point of view it is trivial, but --

MR. ZASSO: Where the Semitropic connection is, for example, is in the end of the Central Valley for us. It just goes right back into the canal. They either take it as a regular turn out or we have to actually physically lower the canal for them to pump back up into us. It is usually at rates anywhere from 50 to several 100 CFS, very small, and we are pumping in that stretch, we would be pumping in the neighborhood of like say around 4,000 CFS, so it is just a very

small increment.

MR. WOODWARD: What if several water banking districts started to think about that, does it help? It really is a panacea, there really isn't any one thing to go after here.

MR. BUI: You have to be careful because extracting ground water has its own problem also. You can't extract -- if there is a certain way, if you extract too much, you are going to lower the water table, you are going to create another problem in the water supply issue also.

MR. ZASSO: The way a lot of the existing turn outs are configured, if you are going to do some type of arrangement like that, at times we are asked to lower the level in the aqueduct for these types of pump in applications, and at times, depending on the rate and the turn out, we have to flatten out our pumping in order to accommodate a lower a reservoir level. We can't pump full capacity, we have to pull it down slightly.

What that means for us is now we are instead of running 13 units at Edmunston on the off-peak period, I now can only run 11 or 12, now

I have to add extra pumping in the other hours to make that happen. It is not something we do very often. It is usually for some type of unusual event or in the case of a water transfer which are coordinated through our department from contractor to contractor, they have to pay the cost of doing that.

Again, there are operational issues that would have to no net impact to the department if there was an application like that.

MR. WOODWARD: It is a systemic impact, we can't just look at it as an individual case.

MR. ZASSO: Correct.

MR. BUI: It is also when you lower the canal basically to accept water, you pump at the lower, and you expend more energy to actually move the water also, so it might defeat the purposes.

MR. WOODWARD: Total energy balance might not look good at all is what I am trying to hear you say.

MS. NEWMARK: I haven't finished reading the whole draft, and maybe you addressed it here, but in an earlier discussion where we are really looking at the user's side. We talked a lot about the timing and the inertia in the water systems

and the fact that it is very different from the energy systems.

In a way, the State Water Project and the Valley Project are like your base load. We are talking about peakers every where else, and we are talking about the fact that the way the agriculture side runs is the farmer has to take 24 hours of flow from midnight to midnight or whenever the clock starts, but actually he only needs it during part of that day.

The problems with a system that is based on large bulk base loading where actually the demand is ideally intermittent if you tried to make it more effective for the purposes of use.

In a way, what I am hearing from you again is that we have a baseload, and if we want to accommodate, you know, Semitropic a 1 percent, 5 percent thing, and yeah, we actually have to do something because 5 percent is not zero, but it has been an awkward thing.

Again, this speaks to our current infrastructure in the way we are trying to scotch tape and bandaid around it versus where we need to go in the next few decades.

Have you had any other experiences where

this shorter time frame accommodations can be made or what are the limitations. I think we have a general idea, and this kind of speaks to the ag discussion we had, which I haven't gotten to read about yet.

MR. TRASK: I did not write about this, I mean, yes, there are --

MS. NEWMARK: Forget it then.

MR. ZASSO: What (indiscernible) do you have about the ag, you mentioned that the contractors take a set amount over a 24 hour period. They may only need it for 12 or 16 hours for that particular day, but they let it run 24 hours. That is primarily how a lot of our turn outs run. We do have some peak turn outs. A lot of them are 100 CFS for four days, and then they will go to a 150.

What it is, it is not so much a demand requirement, there is a demand need for that amount of water. In order to maximize -- they will take it that 24 hours because this farmer may have 30 miles that it has -- or the water district may have 30 miles they have to maintain or they have to operate to. A lot of the turn outs are not automated. They are set manually. There are

maybe one or two people that are managing that district that can't be at every turn out throughout the day to peak here, shut this one down, it is managed to where I need "X" amount of acre feet. Let's set this turn out to this flow, and we will patrol like we normally do. It is a physical issue a lot of times.

A lot of the districts are pretty wide spread. They don't have 30 or 40 people working for them, they may have a handful.

MR. TRASK: About in western Yolo County and the Yolo County Conservation District it's entire electric load consists of four gate controllers, gate valve controllers and no pumping. It is all gravity. Two canals it is automatic, a much simpler system.

MR. KLEIN: On the subject of pumped storage which was covered so well this morning, Tuan and Tio, thank you again for that. It impressed me a couple of things that maybe bears consideration for other potential products. One was the contractors who saw really a ten year financial investment for amortization recapture of that and for pumped storage just on an energy basis, that probably would involve some real risk taking

since the operation of that on a daily basis depends on that price differential and scheduling subject to all the constraints that may be unique and local.

That may be why in many cases people don't build pumped storage to take advantage of that peaking market.

MR. WOODWARD: You are partly saying we need to have a tariff that deals with that in some fashion.

MR. KLEIN: No, you just said that.

MR. WOODWARD: Okay.

MR. KLEIN: I was also impressed -- in your perspective in operating these pumped storage facilities, make use of them when you can that it has system benefits, but you don't operate it to benefit the system. You operate it to meet the beneficial needs of the State Water Project and the on-going mission at a least cost with acceptable risk. That way it helps build load in the off-peak hours, and it helps other generation operate more efficiently, but that is not your purpose.

MR. QUALLEY: In a sense, we are indirectly we are benefitting the entire system as

well because we are interconnected with the grid, and we are scheduled and coordinated with ISO. I mean the more we can smooth out our operations and have more operations because of the on-peak, that helps --

MR. KLEIN: Indeed. As a purchaser, it helps lower the energy costs as well. I guess one of the questions I would ask if knowing how the system is operating today for these investments made in pumped storage in the 60's, would you do it again for the limited types of frequency of use.

They have had a much longer life expectancy than ten years.

MR. QUALLEY: I want just make sure and clarify on the ten years. We just mentioned that number. It just so happened for this Tehachapi (indiscernible). There really isn't pumped storage. It is a peak flow I want to call it a reservoir --

MR. BUI: Off stream.

MR. QUALLEY: Off stream, peak flow facility to allow us to have a place to temporary store the water --

MR. WOODWARD: Sure more flexible pumping.

MR. QUALLEY: -- (indiscernible) off peak

pumping. As I recall the numbers in that particular project, it balanced based on the projections of off-peak and on-peak energy and the cost of that particular project. It happened to pay for itself in about ten years. I don't want you to get the idea that we use that as a criteria on all projects.

Obviously you want to build something that is going to pay for itself within a reasonable period of time.

MR. WOODWARD: One of the things that came up at one of our earlier workshops was presentation on sort of using the canal for generation, water flowing through the canal. Did any of you hear that presentation?

MR. QUALLEY: Didn't hear the presentation, but if you are talking about Verdent, then they have actually talked to us at the department.

MR. WOODWARD: What do you see in that? You are the engineers, tell us what you see.

MR. QUALLEY: Based on the particular type of equipment they were talking about, the flow in the aqueduct probably don't meet their criteria, it was probably less than half of what

they like to see. They were flowing about 10 feet per second as a minimum for efficient operation of the facilities they have were typically two to three feet per second in the aqueduct. It is a pretty slow moving system.

Plus there are maintenance issues with having additional equipment placed in the aqueduct. So, it is our overall conclusion from their presentation it probably wasn't a good application for the aqueduct.

MR. TRASK: Plus, I don't know the specifics on the aqueduct, but I know other agencies that have looked at that, their flows are so low that if you start putting a significant number of turbines down there, you actually can slow down even further --

MR. QUALLEY: That was another issue.

MR. TRASK: -- essentially adding head to your system. When you are two or three to begin with.

MR. WOODWARD: What about other instream flow generation capabilities. You describe one where your sort of instream is a pipe, one is instream of a stream, one is in stream of a canal. That is another one of our topics to think about.

Are there any opportunities you can see for in stream generation anywhere?

MR. QUALLEY: I know there have been a number of entities that have approached us, but with different types of concepts for that basically, some variation on some type of a vein or wheel arrangement. We haven't seen one yet that was applicable for the aqueduct.

MR. WOODWARD: What about things that are not aqueduct, anything that comes to mind?

MR. ZASSO: We discussed earlier about the Coastal Aqueduct. Again, the flow is at most maybe 110 CFS at a peak, and I do know when we built that pipeline that the environmental requirements in that area to get that pipeline put in drove the cost of the water essentially almost higher -- in fact it is higher than what is paid in Southern California, just by the cost of the environmental mitigation that the Department and the water contractors along that stretch have had to pay and will continue to pay. There is a theoretical number on the dollar per acre foot, and it is over $700, per acre foot going into --

MR. TRASK: Was it (indiscernible) issues --

MR. ZASSO: What is that?

MR. TRASK: What were the issues?

MR. ZASSO: There were several endangered species that lived in the habitat in that area. There are lots of archeological sensitive areas within that pipeline stretch. So, you are balancing -- to put a recovery system in there, but the dollars to get there might be prohibitive.

MR. QUALLEY: What I will do, I will talk to the design staff in the project, the development staff that was involved in the Coastal Aqueduct, because I am sure that it had to have been considered in the process. I will get back to you with what the rational was.

MR. WOODWARD: That would be great.

MS. BURTON: It is my understanding that if someone has the contract with you for a certain amount of water, they have to use it or they lose it. I don't know if that is true or not, but that is my understanding is there is an incentive for people that have existing contracts to keep that water flowing to them. Is there any way that having more flexibility with your water requirement, what you have to supply for demand,

if that were more flexible, that you could improve your power generation and in some way give your customer an incentive to say, okay, I don't need my water, I am going to fallow my lands or whatever, so I want to convert that to energy and get that revenue in some way?

MR. QUALLEY: There are two types of costs of what the contractors pay. One is a fixed cost based on their full Table A, and that is what is used to allocate paying off the bond, the fixed type of cost. So, they are going to pay that whether they take a drop of water or not. The other costs are the variable transportation costs, and that is the cost of the energy, that is probably the primary component of the variable cost.

So, those are the two costs the contractor has, and my sense is the contractor signed up for the State Water Project because they needed the water, and they are going to request it because they needed the water. I don't think it is the idea that they feel that they have to take a certain amount of water.

MR. ZASSO: Our contracts with our water contractors, there is provision in them to be able

to store water from year to year without having to take it. It is called carry-over water, and it is typically most of the time it is stored in San Luis. There is some that is stored in Oroville.

What that allows them to do is if they have "X" amount of their Table A water for this year, they can earmark "X" amount of acre feet that they will store from this year to be used next year. There is a caveat that if any of those reservoirs fill, that water is spilt. It is no longer -- if we are filling it, they get their full request.

MR. BUI: Basically, it is not spill as in physical spill, it is theoretical spills meaning that it could have half a capacity at the pump and there is plenty of capacity or water to pump, and your water is sitting on top of the reservoir meaning the difference between what I can pump and what I can deliver to our contractor, that would be the spilling rate. There is no really physical spilling at all, it is just diverting water from the contractors, (indiscernible) contractor to the State Water Project.

MR. TRASK: Essentially, you have a que

and people get bumped out of the que.

MR. ZASSO: Right. Look at it in this range. It could be tagged as carry-over water here. If we start filling that reservoir, most likely it is going to be -- we are going to be able to provide that water than the normal Table A delivery for that year.

MR. BUI: Right.

MR. ZASSO: They are going to be made whole one way or the other.

MR. TRASK: This year might be one of those times where we would have to start bumping people since you are getting so much water (inaudible).

MR. BUI: You know, this year, we didn't spill that much of water so called spill. There is a carry-over water that is Article 21 water which is water they can take over above the entitlement. Meaning that you allocate a certain amount of water for a contractor. If water is plentiful, San Luis is full, and if you don't capture the water, the water is going to flow to the ocean. So, you capture the water and you say, hey, Contractor A, Contractor B, do you have any demand over and above your normal demand. Can you

accommodate this water. If they said yes, we would pump the water for them. Basically, is San Luis is filled, they take most of the water of carry-over out before it is all converted.

MR. TRASK: They would know it is coming.

MR. BUI: Yes, every year.

MR. ZASSO: Right.

MR. BROOME: I wonder if you know how the LA Department operates Castaic. I mean they have apparently a very satisfactory financial return the way they operate Castaic.

MR. ZASSO: It is all our water.

MR. BUI: Yes.

MR. BROOME: Pardon?

MR. ZASSO: It is all our water.

MR. BROOME: I know, your water, but their profit.

MR. ZASSO: Yes, we are well aware of that.

MR. BUI: Basically, we were originally putting in the recovery plans. They offered to put in the pump gen.

MR. QUALLEY: Could the person on the telephone, maybe muffle the microphone there.

MR. TRASK: That mike does not reach him. That is James Park from LADWP --

MR. QUALLEY: Oh, this one doesn't reach James.

UNIDENTIFIED VOICE: Give Ken my regards if you will.

MR. TRASK: James are you there?

MR. PARK: Hello?

MR. TRASK: James, we are talking about you, I don't know if your ears got red there.

MR. PARK: Oh, I wasn't listening.

MR. TRASK: We just brought Castaic as a pumped storage resource. Can you tell us a little bit about your pumped storage operations?

MR. PARK: Oh gosh, I actually wouldn't be the person to talk about the operations. Is anyone from our power site on line by chance, Randy Howard?

MR. WOODWARD: I can jump in here just because I've -- let me jump over here.

MR. PARK: (Inaudible).

MR. WOODWARD: No, he is not here, but I did have the pleasure of talking to Randy and his staff over the last month. I am Jim Woodward with the Energy Commission, and DWP was real firm that

saying their net dependable capacity there at Castaic is 1175 MWs for one hour going forward.

They are adding about 10 MWs a year of capacity, but it is lower than nameplate because of the limitation hydraulically on the pen stock, but they integrate that with their system. They market the peaking energy when they can. It is my recollection that they needed a price differential between peak and off-peak energy of about 30 percent since they were losing 15 percent of the value in each pass. A very efficient design system between (indiscernible) and Pyramid (indiscernible).

I recall them saying it is getting a little harder to find those markets, it is less frequent this year than it has been in past years for peaking energy. It is very important, and they look to using that for integrating 120 MWs nameplate of pine tree wind expected to come on early next year.

MR. ZASSO: One additional impact that we see as the level of our demand that we had on our West Branch that has increased over the last five or six years to where it would be normally down to the neighborhood of a couple of hundred

CFS in the winter time, now we are moving 500 to 600 CFS at a minimum up to over a 1,000 CFS in the summertime.

There has been some impact. We are moving water in the pyramid on a daily and hourly basis, so they have to keep that into consideration when they are doing their pump back operation of operating pyramid within its normal operating range with additional water coming in.

Again, the level of demand on our West Branch and the level of water we've been delivering into the West Branch has increased considerably over the last four or five years.

MR. WOODWARD: What do you attribute it to? That's a big change.

MR. ZASSO: Part of it has to do with expansion down in Southern California. They are building houses and expanding all across Southern California, and some of it I would imagine is tied to the Colorado River Aqueduct. The cuts that MWD took on the Colorado, they are expanding their system eastward as much as they can and maximize their Colorado intact.

MR. BROOME: The gross head goes up at pyramid, and maybe the storage is less than the

eight to ten hours they had?

MR. ZASSO: Storage space, well, yeah, that is probably a good way to put that. Instead of us not having to pump during the day time or in the shoulder hours, they had more flexibility to move the pyramid up and down, we still have to keep that water moving in.

MR. KLEIN: They said that they give DWR credit for an average 45 MWs for the water that comes out the other end of the pipe, your through water.

MR. ZASSO: We were not here when those contracts were put into place, so, we won't take credit for those.

MR. BROOME: Has DWR ever considered the possibility of increasing the capacity of San Luis in particular to cope with the possibility of using excess capacity for daily operation?

MR. TRASK: Generating capacity I assume.

MR. BROOME: Generating and pumping. In other words, right now I understand that during the peak release season, you are using full capacity of release 24 hours a day, so you have no capacity for pumping.

MR. ZASSO: I won't say full capacity 24 hours a day, but at peak delivery time during the year, we are going to fill up the majority of the day with delivery out of San Luis.

MR. KLEIN: If you had a south of Delta storage facility or --

MR. ZASSO: Los Banos ground --

MR. KLEIN: Yeah, Los Banos ground we'll put that one on the ground, it might actually enhance the pumped storage facilities that you have.

MR. ZASSO: Potentially. I don't know. Those are years, if not decades away.

MR. KLEIN: I don't think they are on the table compared to --

MR. ZASSO: Right.

MR. WOODWARD: We have a few other topic areas here of questions, conduit hydro, digester, gas generation, and other renewable generation. Anybody have any thoughts on that?

MS. PARK: I just want to mention, I think that you are probably aware that we are (inaudible) -- am I doing it again -- on the statewide potential for inconduit hydro, that scope is still deliberately limited because of the intent of finding RPS eligible hydro.

Again, we go back to a need to assess what the state's goals are in context of its policy for our RPS because, for example, we did not consider in stream hydro in this study, it is only manmade conduits which are ditches, canals, pipelines. The other thing that we didn't include in this scope, but has merit to look at -- and we didn't include it in the scope for a couple of reasons, but the primary reason was that we are having a lot of difficulty getting this kind of information from the water utilities in view of infrastructure security concerns, and that is the location of pressure reducing valves, which I understand are not only good potential for hydro, but also really good potential for infiltration into the water supply.

We could only do to the extent we bumped across those, we identified them. I just wanted to let you know that is in process.

MR. WOODWARD: Roughly when?

MS. PARK: We are actually about ready to wrap that study up, and so I think the final draft report would be ready in about a month, but you might want to confer with Mike King on that.

MR. TRASK: The figures that I have in

my report came from Mike, so essentially the same information. Mike in ACWA.

MS. PARK: Right. One other thought on the digester gas, I understand also (indiscernible), I don't know much about it is doing studies on the dairy manure issue. I never would have thought of digester gas and Gary or anyone thought, until I met Martha Davis, who wants to put it all together and make this really fabulous feed stock and generate the heck out of it. I just wanted to mention that.

MR. TRASK: Composting facilities.

MS. PARK: Yes, very fascinating. I never thought of it before.

MS. NEWMARK: Actually, we had a meeting with Western United Dairymen, and we were actually talking about air emissions. We weren't talking about power generation. Their issues with respect to the digester also revolved around what kind of greenhouse gasses were emitting and overall what the impact to global warming and air quality, vis a vis the reactive gasses versus the ones that are actually regulated. That is a big issue in the Central Valley.

Since the air quality issues seem to be

wagging the dog with respect to the use of these four dairies in particular, but also smaller generators of fuel. In a way, I don't know what the Commission could do to address this, but I think that there is a combined issue with respect to energy generation, air quality, and long term impact to our environment that you are going to have to get up above the individual trees and start looking at the forest. So, I am just kind of throwing that back in your lap, but I think something positive could be done through your offices.

MR. TRASK: The conclusion was that digester gas generation can actually lower greenhouse gas because of emissions?

MS. PARK: Right now it is being regulated and what they are talking about permitting is basically -- well, the comment that was given was that there was no science involved in the decision. There was sort of a list of chemicals and numbers thrown at them that were not very well generated. Unfortunately, those permitted materials did not include things that were very reactive and were ozone precursors and that were the difference between methane and CO2

and some of the others. Some of them you would actually end up with an increase emission rate of things that were worse long term for the environment, but they just weren't off the specific list.

It was sort of a well intentioned, but not well thought out implementation. As a result, there was a barrier to some of the larger sources to go forward with this because they felt they were being -- how do I say it, in appropriately managed, and it wasn't going to serve the purpose, so why do it after all. You know, look for another option. Given that energy production is very important to us here and the long term impacts to the environment, this discussion has sort of a longer term view, perhaps visiting those emission issues in that context might be helpful because otherwise they are being regulated on a very local basis without a statewide view.

MR. TRASK: I think that is crucial. The few people that have been looking at digester gas but decided not to go through with it, one of the big issues was buying the air emission offset credits. I mean, that is a huge expense right now. If there is any benefit that they are

supplying, I don't think that is factored into the equation at all.

MS. PARK: I wanted to mention something that Martha Davis had mentioned to me, and I am sure I am going to get it wrong, so I will then after I leave this meeting ask her for the correct quote. That is, she told me that she had been in negotiations, and I thought it was with the local air district about getting appropriate credit for bringing the dairy manure into the feed stock for this waste water treatment.

The issue was that by moving the dairy manure, she was solving one air pollution, and yes she was converting it to a different problem, but she wanted full credit for the total package. She said that she had gotten some agreement that is how they would treat it, but like I said I would get more information from her.

MR. TRASK: That is what I was getting at, right now you don't get any credit for reducing greenhouse gas emissions, only the criteria pollutants, some of which are, but they are not really a correlation between the two.

MS. BURTON: There should be some potential credit as well for the ground water

pollution that is avoided by not spreading the manure.

MR. WOODWARD: Unfortunately, it is a different agency that regulates that one, and so it is hard to get all the permitters to agree that, yes, you have done something positive or negative. I think you are right that we ought to have some discussions with folks that understand the complexity and look through possible solutions. It makes sense to do that.

MR. TRASK: Gary, I kind feel like we should probably wrap this up if we are going to have any time to do comments today. Do people want to go into comments on the study today, or should we just save that for Thursday? Silence is --

MR. WOODWARD: I am going to propose a slight change in that discussion. This is primarily for the folks here from DWR, we are looking for ideas that the State, not just the Energy Commission, but that the State ought to undertake in the context of this Integrated Energy Policy Report to do things that would be better than where we are out now. Things we ought to look at, suggestions for us to pay attention to,

all that stuff. If you have any of those now, we would love to hear them. If not, and you want to think about them, we would love to hear them when you are ready to tell us.

We are very interested in your thoughts as to how we might do things better or differently. You can point to us or you can point to others or yourselves, whatever it is, we are interested.

MR. QUALLEY: I don't have any particular things I came today to offer. I think the Department's continued involvement I think will be probably primarily through the Bulletin 160 side of the house that has the overall statewide picture on the water planning. Certainly those of us on the State Water Project side will be working with them and supporting that. I'm not sure if Paul will have some of those additional ideas from that perspective.

MR. TRASK: I did talk with Paul last Friday, and he said that many people in the Statewide Planning Office are reviewing the paper and will be getting those comments.

MR. QUALLEY: Paul and I are in communication as far as coordinating comments.

MR. WOODWARD: If you can think of anything, we are interested in hearing about it.

MR. BROOME: I'd like to make one more suggestion, and that is, at one time, some private developer was planning an underground pumped storage project somewhere in the Mojave Desert area. Underground pumped storage has been tried both in the Midwestern also in New England, or Mid Atlantic area mainly because it isolates the project from any environmental impact.

In other words, you've got a self-contained system, you've run the water down, and no fish, no major impact of the surface. So, if you are looking for something like 10,000 MWs of pumped storage capacity. I think an underground facility in the Mojave Desert might be a good idea.

MR. TRASK: The paper talks about modular pumped storage and it can be virtually any kind of container, underground, or above ground tank, open reservoir, or whatever, but you only charge it once, and then whatever make up you have after that, so it is not a consumptive use. I think there is a lot of potential in that.

MR. BROOME: Cost wise, it may sound

like a lot of money to dig a hole in the ground, but in fact, it doesn't come to that much more than surface reservoirs. If you have a vertical pen stock, that's the shortest distance between the upper and lower reservoir, and that is the ideal from a pumped storage plant designers point of view. That is something from state point of view, it may be something to encourage somebody in the private sector to undertake.

MR. WOODWARD: Okay. I think unless you really want us to spend time on comments, I have a feeling that a lot of folks here look tired, and we ought to ask them to come back fresh on Thursday.

MR. TRASK: I have a feeling that I am very tired, so that sounds very good to me.

MR. WOODWARD: Let's call it a day then.

MR. TRASK: Okay.

(Whereupon, at 2:43 p.m., the workshop was adjourned.)

--oOo--

CERTIFICATE OF REPORTER

I, CHRISTOPHER LOVERRO, an Electronic Reporter, do hereby certify that I am a disinterested person herein; that I recorded the foregoing California Energy Commission Working Group; that it was thereafter transcribed into typewriting.

I further certify that I am not of counsel or attorney for any of the parties to said working group, nor in any way interested in outcome of said working group.

IN WITNESS WHEREOF, I have hereunto set my hand this 7th day of June, 2005.